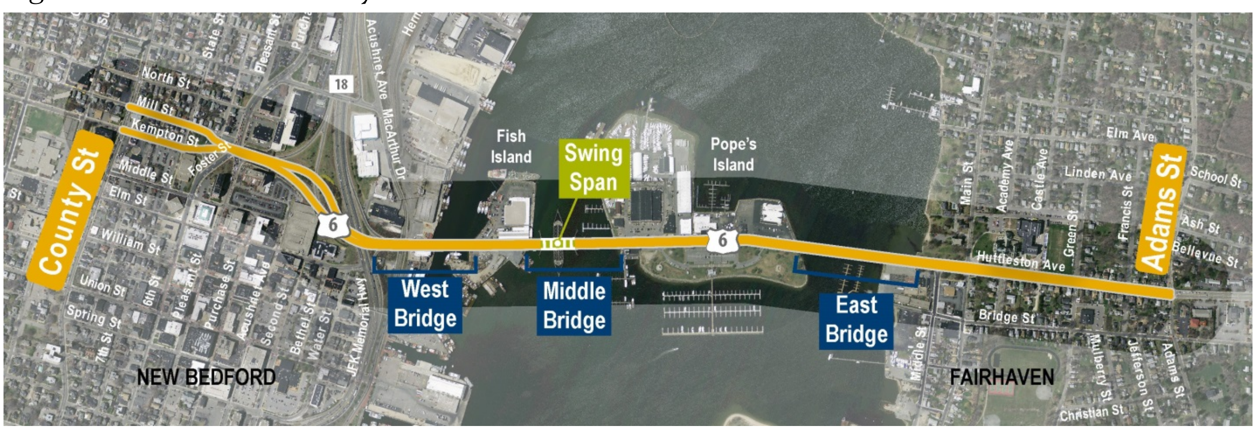
Executive Summary

The purpose of the New Bedford-Fairhaven Bridge Corridor Study was to evaluate multi-modal transportation and associated land use issues, develop potential solutions, and to recommend improvements along the Route 6 corridor between County Street in the City of New Bedford and Adams Street in the Town of Fairhaven (Figure ES.1). Specific focus was given to options and impacts associated with replacement of the swing span of the middle bridge portion of the New Bedford-Fairhaven Bridge (Figure ES.2). The study was conducted utilizing an open and inclusive public-participatory approach that takes into account needs of the Massachusetts Department of Transportation (MassDOT), members of the Study Advisory Group (SAG), and other stakeholders.

Based on the review of existing conditions and the outcome of the alternatives development and screening process, a set of short-, medium-, and long-term recommendations were developed. These recommendations are actions, plans, or projects designed to address the study goals and objectives. Two long-term bridge alternatives are recommended for further analysis and advancement into the MassDOT project development process. These alternatives both include the replacement of the existing swing span and offer the benefit of greater horizontal and navigational clearances. The short- and medium-term recommendations are proposed to improve corridor intersections, bicycle and pedestrian conditions, and the bridge corridor Intelligent Transportation Systems (ITS)/signage system.

Figure ES.1 Route 6 Study Corridor



EXISTING CONDITIONS

The existing New Bedford-Fairhaven Bridge was completed in 1903 and is currently classified as functionally obsolete. The bridge is actually a system of three bridges that connect the mainland across two mid-harbor islands (Fish Island and Pope's Island). The middle bridge includes a moveable swing-span that allows boats to pass through into the northern harbor area while the east and west spans are fixed. The swing span is supported by a central pier and the end abutments. Since its completion over 100 years ago, the bridge has undergone numerous closures and repairs. The length of construction required and frequency of major repairs has accelerated over the past few decades. The current bridge restoration project will address the structural steel repairs to the bridge's floor beams, but an assessment of the bridge's superstructure (i.e., truss structure above the roadway surface) has shown the need for replacement of significant bridge components within the next two decades.

Figure ES.2 New Bedford-Fairhaven Bridge – Middle Bridge Swing Span

As part of the study, a detailed analysis of conditions, issues, and opportunities was completed to evaluate the existing bridge and the Route 6 Corridor. As detailed in Chapter 2, the study identified the following issues, constraints, or opportunities along the Route 6 Corridor:

- **Frequent and lengthy bridge openings causes delays.** Marine traffic has priority over vehicular traffic, so the bridge stays open to accommodate all waiting marine vessels. This results in a varying, but often extensive delay period for vehicles, pedestrians, and bicyclists trying to cross the bridge. Intelligent Transportation Systems (ITS) or electronic message signs are currently utilized in both New Bedford and Fairhaven to inform drivers when the bridge is closed to vehicular traffic. Traffic count data reveals that a decrease in traffic on the bridge approaches occurred when the signs were illuminated indicating that the bridge is closed. However, lengthy traffic queues continue to occur on both sides of the bridge. Improved ITS technology and more strategic placement could decrease traffic queues at the bridge and allow motorists to make detours to minimize delays.
- **Width of bridge opening/horizontal clearance limits vessel size and navigation**. The existing moveable bridge is also a constraint for larger ships accessing the northern waterfront land within the Designated Port Area of New Bedford Harbor. Vessels are limited by the bridge's 95-foot swing span navigational width on either side of the central support pier. To navigate through the bridge, larger vessels require additional pilotage and tug fees to deal with the navigational constraints caused by the bridge, shipping channel, and turning basin. Some larger vessels are unable to navigate the bridge due to these constraints. Development potential in the North Harbor (i.e., the portion of New Bedford Harbor north of the Route 6), is limited by the size of vessels that can access this area of the port. Several properties are available

for redevelopment and there is potential to expand existing maritime uses within the Designated Port Area.

- **Existing vertical underclearance prevents vessels from transiting bridge when it is open for vehicles, pedestrians, and bicyclists.** Emergency vessels cannot transit the existing bridge in the closed position and must wait for the bridge to open. The majority of the existing emergency vessels require 14 feet of vertical clearance. The current bridge has a vertical underclearance of only six feet. Due to the limited vertical underclearance, the majority of vessels, including recreational vessels, require the bridge to open to pass through the channel.
- **Lack of connectivity and consistent facilities creates challenges for pedestrians and bicyclists along the corridor.** The New Bedford-Fairhaven Bridge is the only pedestrian or bicycle access point between downtown Fairhaven and New Bedford. The bridge has a sidewalk on either side of the travel lanes, but there is only one crosswalk between the New Bedford and Fairhaven shores.

LONG-TERM ALTERNATIVES

As described in Chapters 3 and 4 of this report, the study team developed a set of long-term alternatives based on an initial analysis and screening process. This process included a review of conclusions from a number of previous studies, physical limitations of the bridge approaches and clearance issues, and an assessment of the 2014 Existing Condition and the 2035 No Build Condition. The alternatives were then refined during the alternative development process using a Study Advisory Group and public input.

Alternatives Considered

Eight long-term alternatives were developed. A summary of the navigational clearance, vertical clearance, construction duration, and capital costs for each long-term alternative is described below:

- **No Build Alternative: Repair Existing Swing Bridge.** Removal and replacement of the existing swing span trussstructure. The newly constructed structure would be in same configuration as the existing swing span. The 95-foot-wide navigational clearance is maintained. The estimated capital cost is $45 million and the construction phase would take 18 months. A two-week-long roadway closure would be required.
- **Alternative 1: Vertical Lift Bridge (110-135 feet vertical clearance).** Construction of a new vertical lift bridge with 270 feet of horizontal clearance in place of the existing swing span. The estimated capital cost is $90 to $120 million and the construction phase would last 33 to 36 months. A two-week-long roadway closure would be required.
- **Alternative 1T: Tall Vertical Lift Bridge (150 feet vertical clearance).** Construction of a new vertical lift bridge with 270 feet of horizontal clearance in place of the existing swing span. The estimated capital cost is $100 to $130 million and the construction phase would last 33 to 36 months. A two-week-long roadway closure would be required.

- **Alternative 2: Double-leaf Bascule Bridge (Standard).** Construction of a new double-leaf bascule bridge (standard type) with 150 feet of horizontal clearance in place of the existing swing span. The estimated capital cost is $85 to $100 million and the construction duration is 37 months. A two-year-long roadway closure would be required.
- **Alternative 2W: Wide Double-leaf Bascule Bridge (Standard).** Construction of a new double-leaf bascule bridge (standard type) with 220 feet of horizontal clearance in place of the existing swing span. The estimated capital cost is $130 to $160 million and the construction duration is 37 months. A two-year-long roadway closure would be required.
- **Alternative 3: Single-leaf Rolling Bascule Bridge.** Construction of a new single-leaf rolling bascule bridge with 150 feet of horizontal clearance in place of the existing swing span. The estimated capital cost is $50 to $170 million and the construction duration is approximately 26 to 28 months. A three-month-long roadway closure would be required.
- **Alternative 3W: Double-leaf Rolling Bascule Bridge.** Construction of a new double-leaf rolling bascule bridge with 220 feet of horizontal clearance in place of the existing swing span. The estimated capital cost is $90 to $110 million and the construction duration is approximately 26 to 28 months. A three-month-long roadway closure would be required.
- **Alternative 3D: Double-leaf Dutch-Style Bascule Bridge.** Construction of a new double-leaf Dutch-style bascule bridge with 200 feet of horizontal clearance in place of the existing swing span. The estimated capital cost is $100 to $125 million and the construction duration is approximately 26 to 28 months. A three-month-long roadway closure would be required.

All of the long-term alternatives, except the No Build Alternative, would all allow for a wider bridge with a 64-foot-wide right-of-way (ROW). As part of this additional bridge width, four 11-foot-wide vehicular travel lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks would be constructed. The addition of bike lanes across the New Bedford-Fairhaven Bridge would provide a key link in the proposed 50-mile continuous South Coast Bikeway between Cape Cod and Rhode Island.

Alternative Evaluation Summary

As discussed in Chapters 1 and 4, a set of evaluation criteria was established at the study onset to help analyze the long-term alternatives:

- Bridge Operations (i.e., vertical clearance, number of openings);
- Transportation Impacts (i.e., vehicle delay, connectivity);
- Safety (i.e., emergency vehicle access, navigational safety);
- Economic Development (i.e., shipper cost savings);
- Environment (i.e., coastal or wetland resource impacts);
- Community (i.e., open space or cultural resource impacts); and
- Alternative Feasibility (i.e., costs, construction duration).

Each long-term alternative was evaluated using these criteria. In addition to the quantitative or qualitative information provided, a rating system used to identify the significance of the impact or benefit. The following is the legend for the rating system utilized:

● = Minor Negative Impact or Most Positive Benefit

◒ = Moderate Impact or Minor/Moderate Positive Benefit

○ = Significant Negative Impact or Least Positive Benefit

The complete evaluation summary tables are presented in Chapter 4 for all eight long-term alternatives. Tables ES.1 and ES.2 provide a brief comparison matrix that identifies the "differentiators" that were used to identify the primary benefit or constraint of each long-term alternative. The red cells in the following tables identify the primary or most noteworthy difference among the alternatives. The yellow cells highlight the secondary difference among the alternatives.

The primary differentiators between the long-term alternatives are the issues regarding height or vertical clearance limitations, construction duration and lengthy roadway closures, long-term reliability concerns, and navigational width constraints.

- **Height/Vertical Clearance Limitations.** Unlike all the other alternatives, Alternative 1 and 1T are vertical lift bridges that have vertical underclearance constraints when the bridge is open to vessels.
- **Horizontal Clearance Limitations.** All of the build alternatives increase the horizontal clearance of the bridge opening. The No Build Alternative does not increase the horizontal navigational width from 95 feet. A wider navigational clearance is desired to reduce vessel delays and lower shipping costs. Two of the alternatives, Alternative 2 and 3, increase the width to 150 feet. The five other alternatives offer wider navigational widths, between 200 and 270 feet.
- **Construction Duration/Roadway Closures.** The construction duration varies greatly between alternatives, including the length of roadway closures. The construction duration for the No Build Alternative is 18 months while the two double-leaf bascule bridges (Alternatives 2 and 2W) require a three-year-plus construction period. These two standard bascule bridges require extensive in-water work that will also require a two-year complete roadway closure. This compares to the other alternatives that would require two-week-long or three-month-long roadway closure.
- **Capital Costs.** Another primary differentiator is the capital costs, which range from a low of $45 million in the No Build Alternative to $130-160 million for Alternative 2W (Wide Double-leaf Bascule Bridge).
- **Long-term Reliability Risk.** The other primary difference between alternatives is the long-term reliability risk. Some moveable bridge types are at a greater risk of inoperability than other types due to the nature of their design and the climate that they operate within. Due to the span width and length required, Alternatives 3 and 3W (rolling bascule bridges) were determined to have higher risks for long-term reliability. The long-term reliability of Alternative 3D, the Double-leaf Dutch-style

Bascule Bridge, is unknown at this time due to the limited number of comparable bridges with similar span widths and lengths.

Table ES.1. Alternative Comparison Matrix (Alternatives 1, 1T, 2, and 2W)

Evaluation Criteria	Alternative 1: Vertical Lift Bridge (Rating)	Alternative 1T: Vertical Lift Bridge (Rating)	Alternative 2: Double-Leaf Bascule Bridge (Rating)	Alternative 2W: Double-Leaf Bascule Bridge (Rating)
Feet of vertical clearance (vessel height)	110-135 feet ○	150 feet ○	Unlimited ●	Unlimited ●
Feet of horizontal clearance (vessel width)	270 feet ●	270 feet ●	150 feet ◒	220 feet ◒
Impact to safe navigation	Greatly Improved ●	Greatly Improved ●	Moderately Improved ◒	Greatly Improved ●
Visual impacts	Some Impact ○	Some Impact ○	No Impact ●	No Impact ●
Long-term reliability risk	Medium Risk ◒	Medium Risk ◒	Medium Risk ◒	Medium Risk ◒
Capital costs	$90-$120 Million ○	$100-$130 Million ○	$85-$100 Million ◒	$130-$160 Million ○
Annual operating and maintenance costs	$490,000 ◒	$490,000 ◒	$490,000 ◒	$490,000 ◒
Construction duration	33 months ○	33 months ○	37 months ○	37 months ○
Construction phase impacts to vehicular traffic	2 week road closure ●	2 week road closure ●	24 month road closure ○	24 month road closure ○
Construction phase indirect impacts to abutting businesses	Significant access impacts ○	Significant access impacts ○	Significant access impacts ○	Significant access impacts ○

Table ES.2. Alternative Comparison Matrix (Alternatives 3, 3W, 3D, and No Build)

Evaluation Criteria	No-Build: Repair Existing Swing Bridge	Alternative 3: Single-Leaf Rolling Bascule Bridge (Rating)	Alternative 3W: Double-Leaf Rolling Bascule Bridge (Rating)	Alternative 3D: Double-Leaf Dutch-Style Bascule Bridge (Rating)
Feet of vertical clearance (vessel height)	Unlimited ●	Unlimited ●	Unlimited ●	Unlimited ●
Feet of horizontal clearance (vessel width)	95 feet ○	150 feet ◒	220 feet ●	200 feet ●
Impact to safe navigation	N/A	Moderately Improved ◒	Greatly Improved ●	Greatly Improved ●
Visual impacts	N/A	Limited Impact ◒	Limited Impact ◒	Limited Impact ◒
Long-term reliability risk	Medium Risk ◒	High Risk ○	High Risk ○	TBD
Capital costs	$45 Million ●	$50-$70 Million ●	$90-$110 Million ◒	$100-$125 Million ◒
Annual operating and maintenance costs	$400,000 ●	$400,000 ●	$490,000 ◒	$490,000 ◒

Evaluation Criteria	No-Build: Repair Existing Swing Bridge	Alternative 3: Single-Leaf Rolling Bascule Bridge (Rating)	Alternative 3W: Double-Leaf Rolling Bascule Bridge (Rating)	Alternative 3D: Double-Leaf Dutch-Style Bascule Bridge (Rating)
Construction duration	18 months ●	26 months ◒	26 months ◒	26 months ◒
Construction phase impacts to vehicular traffic	2 week road closure ●	3 month road closure ◒	3 month road closure ◒	3 month road closure ◒
Construction phase indirect impacts to abutting businesses	Minor-Moderate access Impacts ●	Moderate access impacts ◒	Moderate access impacts ◒	Moderate access impacts ◒

STUDY RECOMMENDATIONS

As outlined in Chapter 5, a set of recommended short-, medium-, and long-term actions were developed to address needs of the New Bedford-Fairhaven Bridge Corridor.

Long-Term Alternatives Recommended for Advancement

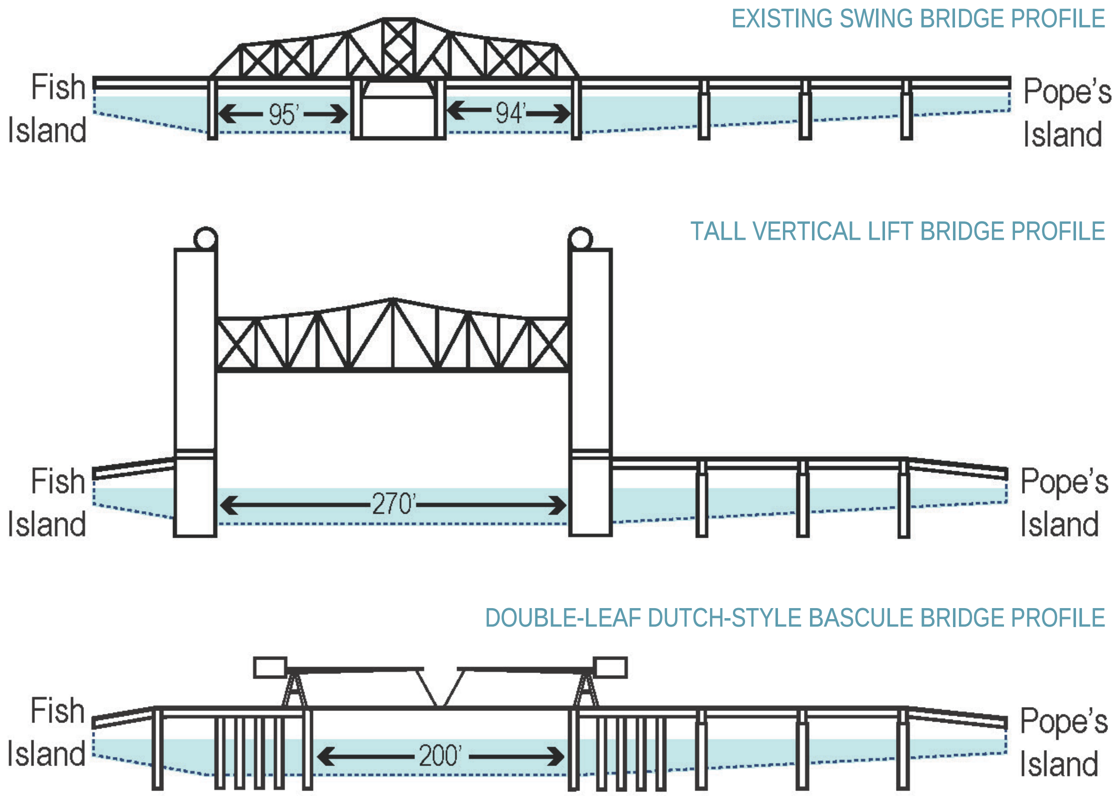
During the alternatives evaluation process, it was determined that of the eight long-term alternatives considered, two build alternatives have the potential to provide the most effective long-term option. These two options were recommended for advancement because they would result in fewer impacts as compared to the other alternatives, while offering the benefits of greater horizontal and navigational clearances. However, additional information, design, and analysis are needed before determining a preferred alternative. As shown in Figure ES.3, the two alternatives recommended for advancement into the project development phase are:

- **Alternative 1T: Tall Vertical Lift Bridge,** and
- **Alternative 3D: Double-leaf Dutch Bascule Bridge.**

Described in more detail in the implementation section later in this Executive Summary, two additional studies would need to be undertaken as part of the project development phase, which is done concurrently with the National Environmental Policy Act (NEPA) permitting process. These additional studies are required to more fully understand site-specific details and navigational issues before a specific bridge type could be identified as the preferred alternative:

- **Bridge Type Study.** After collecting site-specific details (site survey, geotechnical data, force, and load criteria), MassDOT would undertake a study during the Preliminary Design phase to assess the design feasibility of the two recommended bridge types (see Figure ES.1) and respective costs.
- **U.S. Coast Guard Navigational Evaluation.** As part of the NEPA permitting process, this evaluation would be conducted to determine the ability of the recommended bridge alternatives to meet current and future navigational needs concerning horizontal and vertical clearances.

Figure ES.3. Recommended Long-Term Alternatives Bridge Profiles



Short/Medium-Term Recommendations

In addition to the recommended long-term alternatives for the replacement of the New Bedford-Fairhaven Bridge, a number of short-term (less than five years) and medium-term (less than ten years) improvements have been considered and analyzed as part of the study. The recommended improvements outlined in Chapter 5 include intersection improvements, bicycle-pedestrian improvements and ITS/signage improvements. More detailed analysis is provided in Chapter 4 or Chapter 5, including the potential impacts, benefits, and costs of each improvement.

CORRIDOR INTERSECTION IMPROVEMENTS

A number of short-term improvements including changes to signal cycle length, timing splits or phasing, and coordination offset modifications are recommended at the following intersections once ongoing roadway construction projects are completed in late 2015:

- Mill Street and Cottage Street;
- Kempton Street and Cottage Street;
- Mill Street and County Street;
- Kempton Street and County Street;
- Kempton Street/Mill Street and Purchase Street ("Octopus Intersection");
- Huttleston Avenue and Middle Street;

- Huttleston Avenue and Main Street; and
- Huttleston Avenue and Adams Street.

Depending upon the procedures used to make the changes, costs would be less than $20,000 for all intersections.

BICYCLE AND PEDESTRIAN IMPROVEMENTS

As discussed, the expanded ROW included in either of two recommended long-term alternatives would allow for the addition of bike lanes across the New Bedford-Fairhaven Bridge. This segment of Route 6 is included as part of the proposed 50-mile continuous South Coast Bikeway between Swansea and Wareham, Massachusetts. Completion of bike lanes on the New Bedford-Fairhaven Bridge would provide a key link in this regional bike facility. Additionally, three bicycle and pedestrian improvements are recommended for short-term implementation as soon as the ongoing roadway construction projects are completed in late 2015.

- **Bicycle and pedestrian path along Route 6 from Pleasant Street to Route 18**. A pedestrian path that provides a more direct path for pedestrians between the Kempton Street/Mill Street and Purchase Street and the Route 18/Elm Street intersection is recommended for the corridor. The recommended 10- to 12-foot-wide path would be located on the south side of the Route 6 within the existing ROW. A four- to six-foot-high fence would be installed to provide separation between the new path and the eastbound Route 6 travel lanes. The estimated cost for this 0.25-mile long multi-use path is $350,000. To ensure that safety is maintained along the corridor, design of the path would require appropriate roadway separation, fencing, and lighting.
- **New pedestrian ramp and staircase between Route 6 and MacArthur Drive.** A new ramp for pedestrians and bicyclists is recommended to replace an existing staircase that connects the end of the sidewalk onthe north side of the Route 6 and MacArthur Drive. The new ADA-compliant ramp would provide a safe and direct connection for bicyclists and pedestrians on the north side of the roadway. The estimated cost for the ramp structure is $450,000.
- **Completion of sidewalk network along MacArthur Drive.** Construction of an 85-foot-long sidewalk on the west side of MacArthur Drive just north of Route 6 to close a gap in the local pedestrian network. It is anticipated that MacArthur Drive would become the primary pedestrian route from downtown New Bedford and Route 6 to the proposed Whale's Tooth Commuter Rail Station located north of the corridor. The estimated construction cost of the sidewalk is $15,000, not including additional funding to acquire property rights needed for construction.

VARIABLE MESSAGE/ITS SIGNAGE

The addition of one or more of the following short- and medium-term alternatives is recommended to complement the existing ITS/electronic messaging signage system.

- **Complete replacement of existing system with new changeable message signs.** To provide additional information regarding the status of the bridge, the new system would be schedule-based or provided (through a semi-automated system) from the bridge operator. The estimated cost for this short-term recommendation is approximately $750,000 to $1,000,000. The replacement system is in the planning stages with MassDOT.
- **Expansion of ITS/signage system**. In addition to replacement of the existing signs, this medium-term alternative includes the expansion of the system to provide additional information to travelers at locations where they could make diversion decisions. Additional signs would be provided on I-195 and at three intersections along Route 6 (Route 240, Middle Street, and Adams Street) in Fairhaven. The estimated cost for the expansion of the system is $400,000.
- **Upgrades to the ITS/signage system.** This medium-term alternative includes upgrades to the replacement system with more advanced technology that would allow signs to provide additional information regarding travel time to the bridge and the bridge status. This system is similar to the MassDOT "GO Time" System that relies on Bluetooth-based real time traveler information to provide travel times. These types of signage are relevant for select sign locations, including along I-195 and the Route 240/Route 6 intersection. Assuming the other ITS/changeable signs noted above have already been installed, the cost to integrate bridge signs into the "GO Time" system is estimated to cost approximately $100,000.

As part of the study public comment process, it was identified that the signage and pavement marking plans for the completion of the current construction may warrant reconsideration. Since the importance of the pedestrian environment within the corridor has been highlighted as part of this study, another evaluation of the planned locations and configurations of crosswalks appears warranted. Additionally, it was noted that "no-idling" signs along the swing bridge roadway approaches may improve local air quality. Further evaluation of the legal and safety considerations would be required before signage directing motorists to turn-off their engines within the traveled is recommended.

- **Short-term signage and pavement marking evaluations.** – Evaluate restoration and configuration of the Pope's Island crosswalk and the potential for "no idling" signs along the swing bridge roadway approaches.

IMPLEMENTATION

As described in Chapter 5, implementation of the short-, medium-, and long-term recommendations will require coordination between a number of agencies. Given transportation funding constraints, the recommended improvements, especially major infrastructure projects, would likely need to be integrated into other local and regional transportation planning programs. The implementation of the recommended alternatives would be coordinated through the MassDOT Project Development and Design Process described in Chapter 5

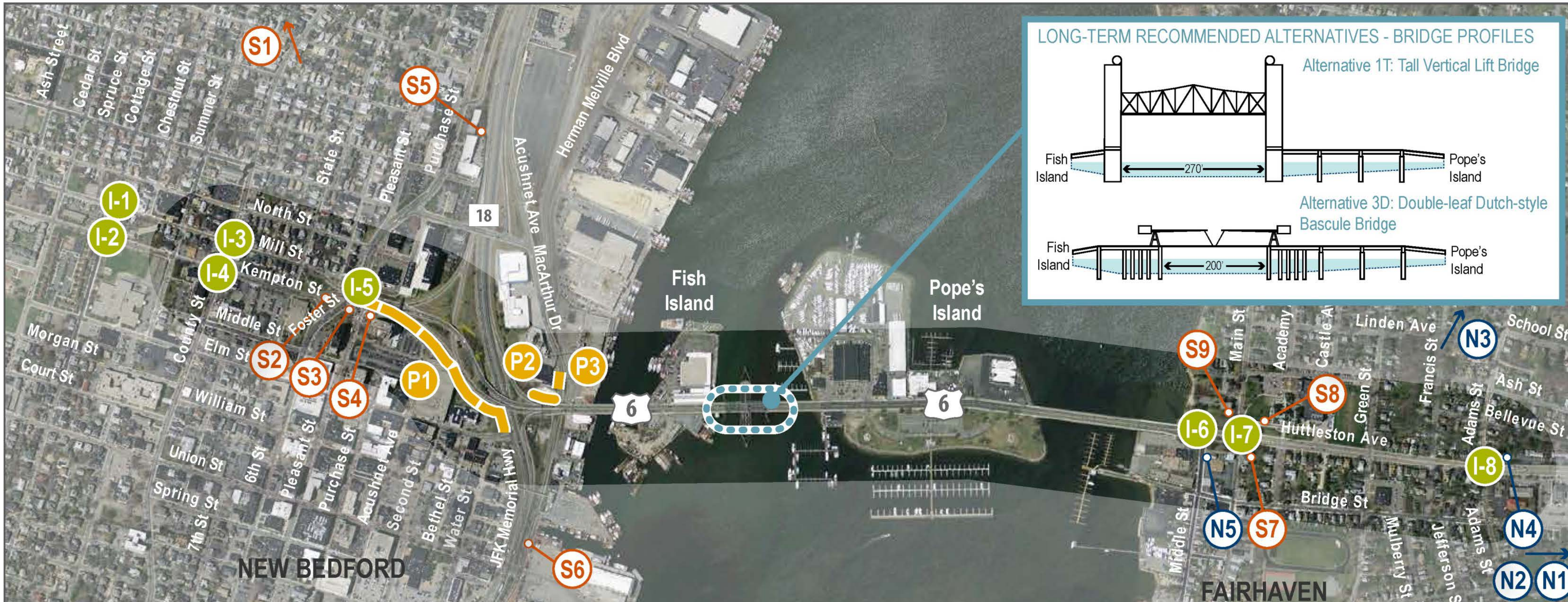
To assist in the completion of the recommended short-, medium-, and long-term recommendations, an implementation summary table was prepared to outline the future actions that various agencies or organizations would need to take. Table ES.3 outlines the recommended studies, actions, or projects. The timeframe, lead agency responsible for implementation, and coordinating agencies are also described. The recommendations are shown on Figure ES.4.

Table ES.3. Short-, Medium- & Long-Term Recommendations Implementation Summary

Study/ Action/ Project	Description	Timeframe	Lead Agency	Coordinating Agencies
Long-Term Recommendations				
Advance Project into Project Initiation	Completion of Project Initiation Form (PIF) and review by Project Review Committee.	Short-term	MassDOT	Southeastern Massachusetts Metropolitan Planning Organization (SMMPO), Project Review Committee
Evaluate projects for inclusion on MPO's RTP/TIP	Evaluation and prioritization of study recommendations as part of the RTP update and TIP.	Short-term	SMMPO	Municipalities, MassDOT
Advance Project into Environmental Permitting, Design and Right-of-Way Process	Following PIF review and inclusion into RTP and TIP, complete NEPA permitting and preliminary design phase.	Short- to Medium-term	MassDOT	SMMPO
Conduct Bridge Type Study	During preliminary design phase, study feasibility of vertical lift bridge or double-leaf Dutch-style bascule bridge.	Short- to Medium-term	MassDOT, design team	SMMPO, municipalities
Conduct U.S. Coast Guard Navigational Evaluation	During NEPA permitting process, detailed evaluation to determine ability of recommended bridge alternatives to meet navigational needs concerning horizontal and vertical clearances.	Short- to Medium-term	MassDOT, U.S. Coast Guard	SMMPO, municipalities
Short- & Medium-Term Recommendations				
Corridor intersection improvements	Implementation of improvements including changes to signal cycle length, timing splits or phasing, and coordination offset modifications at several corridor intersections.	Short-term	MassDOT	Municipalities
Bicycle and pedestrian path along Route 6 from Pleasant Street to Route 18	Design and construction of new 10- to 12-foot-wide multi-use path in existing ROW.	Short- to Medium-term dependent on funding availability.	MassDOT	SMMPO, municipalities
New pedestrian ramp and staircase between Route 6 and MacArthur Drive	Design and construction of new ADA-compliant pedestrian ramp and staircase in existing ROW.	Short- to Medium-term dependent on funding availability.	MassDOT	City of New Bedford

Study/ Action/ Project	Description	Timeframe	Lead Agency	Coordinating Agencies
Completion of sidewalk network along MacArthur Drive	Design and construction of 85-foot-long sidewalk. May require easement or property acquisition.	Short- to Medium-term dependent on funding availability.	City of New Bedford	-
Variable message/ITS signage	Evaluation of options, design, and construction of new and replacement variable message/ITS signage in existing and additional locations.	Short- to Medium-term	MassDOT	-
Evaluate signage and pavement markings	Evaluate signage and pavement markings to be installed after current construction project.	Short-term	MassDOT	-

Figure ES.4 Short-, Medium- & Long-term Recommendations



SHORT- & MEDIUM-TERM RECOMMENDATIONS

Replacement Variable Message/ITS Signage
S1: I-195 EB (inoperable)*
S2: Kempton Street EB at Pleasant Street
S3: Pleasant Street SB at Route 6
S4: Purchase Street NB at Route 6
S5: Route 18 SB (after Pleasant Street exit)
S6: JFK Highway NB at Union Street
S7: Huttleston Avenue/Main Street (SW corner)
S8: Huttleston Avenue/Main Street (NW corner)
S9: Huttleston Ave/Main Street (WB signal arm)

New Variable Message/ITS Signage
N1: Route 6 WB at Route 240*
N2: Route 240 NB at Route 6*
N3: I-195 WB*
N4: Huttleson Avenue WB at Adams Street
N5: Middle Street NB at Huttleson Avenue

Corridor Intersection Improvements
I-1: Mill Street/Cottage Street
I-2: Kempton Street/Cottage Street
I-3: Mill Street/County Street
I-4: Kempton Street/County Street
I-5: Mill Street/Kempton Street/Pleasant Street
I-6: Huttleston Avenue/Middle Street
I-7: Huttleston Avenue/Main Street
I-8: Huttleston Avenue/Adams Street

Bicycle/Pedestrian Improvements
P1: Bike/pedestrian path along Route 6 (Pleasant Street to Route 18)
P2: New bike/pedestrian ramp (Route 6 to MacArthur Drive)
P3: MacArthur Drive sidewalk connection

LONG-TERM RECOMMENDATION

Advance Alternatives through Project Initiation & Environmental Permitting, Design & ROW Process

*Not Shown on this Graphic

NEW BEDFORD-FAIRHAVEN BRIDGE
CORRIDOR STUDY

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Chapter 1 - Introduction

1.1 STUDY PURPOSE

The purpose of this study was to evaluate multi-modal transportation and associated land use issues, develop potential solutions, and to recommend improvements along the Route 6 corridor between County Street in the City of New Bedford and Adams Street in the Town of Fairhaven (Figure 1.1). Specific focus was given to options and impacts associated with replacement of the middle bridge portion of the New Bedford-Fairhaven Bridge (Figure 1.2). It was important that the study was conducted utilizing an open and inclusive public-participatory approach that takes into account needs of the Massachusetts Department of Transportation (MassDOT), members of the Study Advisory Group (SAG), and other stakeholders.

Figure 1.1 Route 6 Study Corridor

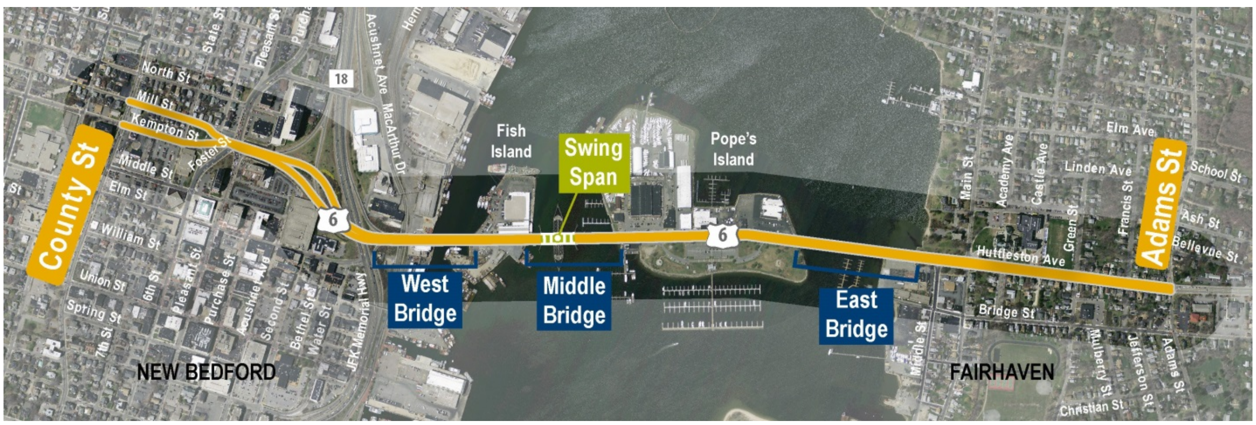


Figure 1.2 New Bedford-Fairhaven Bridge – Middle Bridge Swing Span

1.2 STUDY BACKGROUND

1.2.1 Study Area

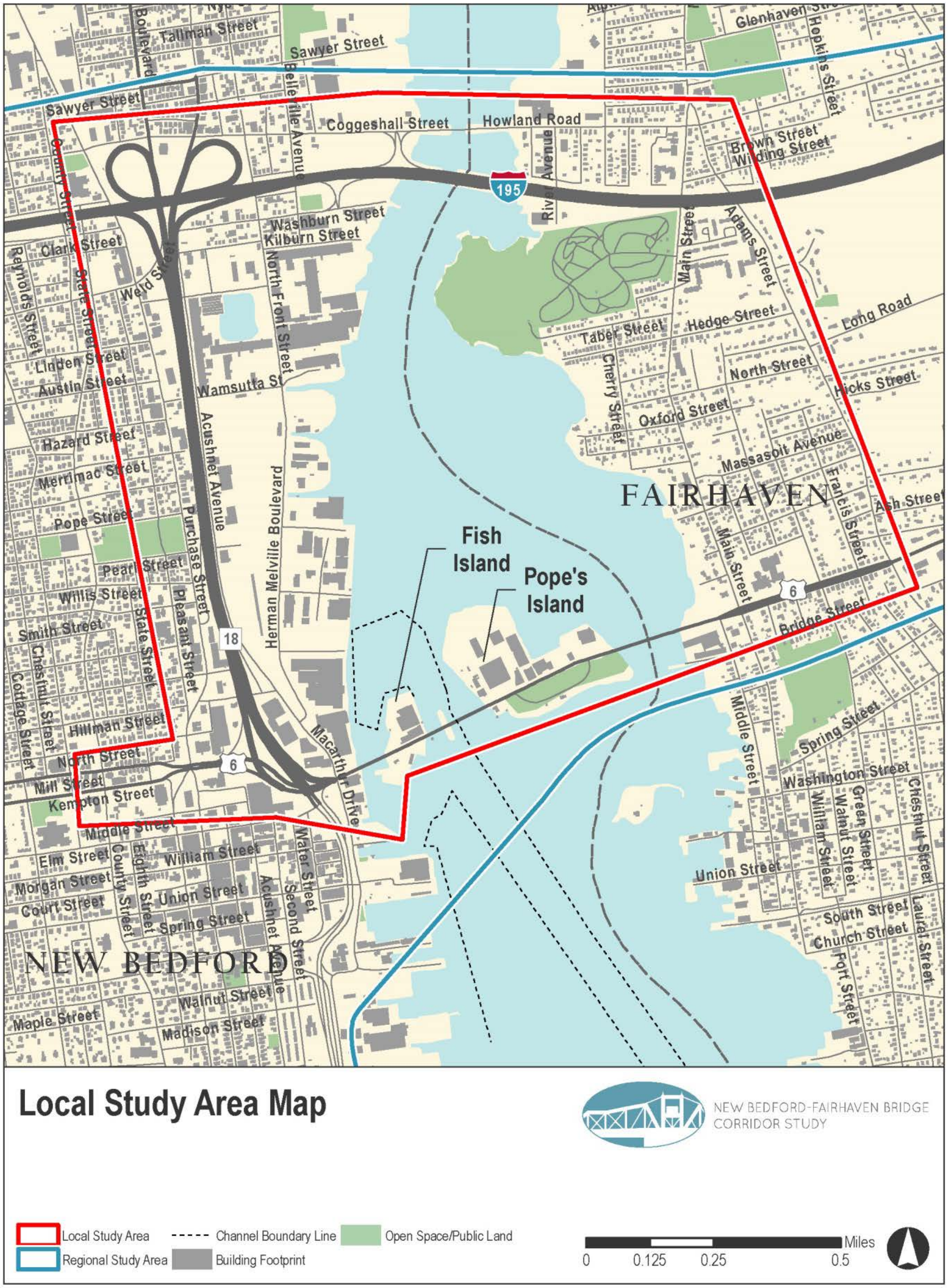
The existing New Bedford-Fairhaven Bridge was completed in 1903 and is currently classified as functionally obsolete. The bridge is actually a system of three bridges that connect the mainland across two mid-harbor islands (Fish Island and Pope's Island). The central bridge includes a moveable swing-span that allows boats to pass through into the northern harbor area while the east and west spans are fixed.

As shown in Figure 1.3, two study areas were defined to help identify and analyze the existing conditions and impacts of a potential project:

- A Regional Study Area was defined to help assess regional impacts such as traffic diversions. As indicated on Figure 1.3, the Regional Study Area is generally defined as Route 140 to the west, Route 240 to the east, Allen Street and Route 6 to the south, and Coggeshall Street/Howland Road to the north.
- A Local Study Area was designated that includes the area in which most of the study analysis will occur. As shown in Figure 1.4, the Local Study Area generally includes the area between Route 6 to the south, Coggeshall Street/Howland Road to the north, Adams Street to the east, and County Street and Pleasant Street to the west. This Local Study Area encompasses the area generally surrounding the northern half of the New Bedford Harbor.

Figure 1.3 Regional Study Area Map

Figure 1.4 Local Study Area Map



1.2.2 Issues with Existing Bridge

The New Bedford-Fairhaven Bridge consists of highway segments on Fish Island and Pope's Island and three separate bridge structures. The middle bridge is the segment that contains the swing span or movable bridge section. This segment has one fixed span approach to the west of the swing span and four to the east, all of the original steel girder construction. The swing span is a 289-foot long rim-bearing truss bridge that rests on a central granite masonry pier. When in the closed position (closed to marine traffic), the swing span is supported by the center pier and the end abutments. When the bridge is open, the bridge structure is supported by the center pier alone and vessels are able to pass in two channels (94 and 95 feet wide) on either side of the pier.

On average, it takes between 12.5 and 22.5 minutes to fully open and return the swing span to a closed position.[1] The minimum time to open and close the bridge is 7.5 minutes. The increased time to open and close is due to the time it takes for pedestrians or vehicles to clear the bridge and vessels to pass through the bridge. The bridge is scheduled to open hourly between 6:00 a.m. and 6:15 p.m. During the evening and overnight, the bridge is opened on-demand. Per federal regulations established in Title 33 (Navigation and Navigable Waters), Part 117 (Drawbridge Operation Regulations), Sections 117.1 to 117.59 (General Regulations and Specific Regulations) and 117.585 (New Bedford Harbor), marine traffic has priority over vehicular traffic, so the bridge stays open to accommodate all waiting marine vessels. This results in a varying, but often extensive delay period for vehicles, pedestrians, and bicyclists trying to cross the bridge.

Additionally, the moveable span suffers from long-term deterioration despite extensive maintenance repairs. According to the 2013 National Bridge Inspection Standards (NBIS) inspection report, the machinery and operating systems are in poor condition and require continued corrective maintenance and replacement of critical parts.

The existing moveable bridge is also a barrier for larger ships accessing the northern waterfront land within the designated harbor areas of New Bedford Harbor. Vessels are limited by the bridge's 92-foot swing span navigational width. According to the 2010 New Bedford-Fairhaven Municipal Harbor Plan, the future development of harbor activities north of Route 6 (including expansion of refrigerated cargo operations, short sea shipping operations, ferry, cruise ship and excursion/shuttle boat operations, etc.) is constrained by the horizontal clearances of the existing swing-span bridge.

1.2.3 Past Studies and Plans

Numerous studies and plans have been completed over the past half century to evaluate the condition and function of the bridge. A description of the key plans and studies over the last fifty years is provided below:

[1] Average opening time based on time surveys conducted during Spring 2014.

- **1966: Southeastern Massachusetts Comprehensive Transportation and Arterial Study (Department of Public Works, Tippets-Abbet-McCarthy-Stratton, 1966).** This study stated, "the replacement of the existing structure by providing greater vertical and horizontal clearance may be justified on the basis of forecasted vehicular and vessel traffic, trends in ship construction, and bridge construction and operating costs."
- **1965-1967: Legislative Special Commission Study for Bridge Replacement. Report of the Special Commission Authorized to Make an Investigation and Study of the Advisability and Feasibility of Replacing the Present Drawbridge Known as the New Bedford-Fairhaven Bridge with a Bascule Bridge of a High-Level Bridge) (Special Commission of the Mass. House of Representatives, 1967)** Proposal to undertake an engineering study of the bridge.
- **1969: Feasibility Study on the Replacement of the New Bedford-Fairhaven Bridge (Mass. Department of Public Works, Sverdrup, and Parcel, 1969).** Study concluded that replacement will probably be required before 1990 due to age of bridge and increased shipping traffic.
- **1977: New Bedford-Fairhaven Route 6 Bridge Corridor Planning Study Report (Mass Department of Public Works, Southeastern Regional Planning and Economic Development District, 1977).** This report recommended the replacement of the bridge with a new double bascule bridge with a 150-foot horizontal clearance to match the channel width.
- **1978: New Bedford-Fairhaven Bridge, A Review of the Facts Favoring Timely Replacement, New Bedford-Fairhaven Harbor Master Plan (New Bedford-Fairhaven Harbor Master Planning Commission, May 1978).** Plan developed for new bridge to spur oil crisis induced maritime development.
- **1979: New Bedford-Fairhaven Bridge, Route 6 Over New Bedford Harbor: Draft Engineering Study Report (Massachusetts Department of Public Works, Sverdrup, Parcel and Associates, September 1979).**
- **1985: Environmental Assessment: Replacement of the New Bedford-Fairhaven Bridge (USDOT, FHA, Mass DPW, May 1985).** The Preferred Alternative (out of 19) was new bridge construction along an alignment nearly identical to the existing bridge that provides a vertical clearance at the bascule span of approximately 10 feet, which is slightly higher than the existing bridge. The preferred alternative involved roadway construction on the approaches and a four-lane bridge with a moveable span of the double bascule type and fixed approaches on either side. The cost was approximated at $35 million.
- **1987: Swing-Span Bridge for Route 6 across Acushnet River (A.G. Lictenstein and Associates, October 1987).** This study evaluated the rehabilitation of the bridge for the New Bedford Department of Public Works. Repair was preferred at this time likely due to concerns about environmental issues in the harbor and the cost of replacement.
- **2002**: **New Bedford/Fairhaven Harbor Plan (City of New Bedford, Town of Fairhaven, VHB, August 2002).** This plan envisioned the "wholesale relocation of the Route 6 crossing" to the north. The proposed bridge would connect to Wamsutta Street in New Bedford and open up opportunities for the north terminal and expansion of a new harbor terminal on Pope's Island.

- **2004: Draft Conceptual Alternative Study for the Relocation of the Route 6 Bridge Over New Bedford Harbor. (City of New Bedford, STV Incorporated, VHB, Inc. December 2004)** Initiated in 2000 by the New Bedford Redevelopment Authority but delayed until 2003, this study builds upon the 2002 harbor plan that called for the relocation of the bridge to the north. Funded through the Federal Highway Administration's Transportation and Community System Preservation (TCSP) grant program, the study evaluated three conceptual alternative bridge structure types, all relocated to the north to connect directly to the planned intermodal facility near Wamsutta Street in New Bedford. The recommended alternative was a high-level movable bridge option with a 22-foot vertical clearance at an estimated cost of $73.4 million. A federal delegation request for $3 million was submitted in 2003 to complete an Environmental Impact Statement (EIS) to further develop the bridge relocation project. A $1.4 million federal earmark from the 109th Congress was awarded, but never used to complete an EIS. The plan did not consider replacement of the bridge in its current location and did not fully address how the new bridge alignment would connect with the Route 18 and the rest of the existing road network in New Bedford. The proposed alignment now conflicts with the location of the CAD cells used as part of the ongoing harbor dredging and cleanup project.
- **2006: Fairhaven the Route 6 Corridor Safety Study (SRPEDD, September 2006).** This study evaluated crash data on the Route 6 corridor in Fairhaven and offered recommendations including changes to signalization, vehicle speed, signage, and police enforcement. In 2013, signal and intersection improvements were completed on Route 6 (Huttleston Avenue) at four locations: Middle Street, Main Street, Green Street, and Adams Street.
- **2010: New Bedford/Fairhaven Municipal Harbor Plan (May 2010).** This updated harbor plan includes the ongoing dredging process established through the State Enhanced Remedy (SER) and the location of the CAD disposal sites. The plan differs from the 2002 harbor plan by supporting the replacement of the New Bedford-Fairhaven Bridge in its current alignment and not relocation to the north. The plan proposes a double bascule bridge to increase the bridge opening from the current effective width of 90 feet to a new width of 150 feet.
- **2014:** MassDOT begins current bridge/corridor study.

1.2.4 Ongoing Bridge Maintenance

Since completion over 100 years ago, the bridge has undergone numerous closures and repairs. MassDOT is currently in the process of a $60 million project to increase the lifespan of the east and west spans of the bridge through improvements that include replacing joints and bearings, cleaning and repairing steel, and repairing the concrete and granite piers and abutments. Initially, the ongoing reconstruction project did not include any work on the middle bridge moveable span, but the project was modified during the planning process to include bridge restoration.

Based on a review of numerous studies and reports, a brief history of the bridge repairs and modifications is provided below:[2]

- **1903:** Bridge construction completed at final cost of $1.387 million. Planning and design began in 1883 and the middle bridge (swing span) was completed between 1897 and 1899.
- **1920:** The first significant repairs were made to the bridge.
- **1931:** The bridge underwent its first major overhaul after Massachusetts Department of Public Works assumed operational responsibility from Bristol County in 1930.
- **1932-1960:** Additional repairs were made at least eight times during these three decades.
- **1961:** The deck and deck framing of the fixed spans were replaced and the abutments were altered and repaired.
- **1972:** The western end of bridge was completely replaced in conjunction with ramp construction for newly constructed Route 18.
- **1984:** A major repair was completed in 1984.
- **1989:** The bridge closed for six weeks for repair in 1989.
- **1995:** The bridge closed again for 11 months in 1995 at a repair cost of $16 million. After just three weeks open, the bridge broke down again and was closed for an additional three weeks.
- **March 2012:** The bridge closed for three weeks to make critical repairs and electrical upgrades, including transformer and motor repairs.
- **April 2014:** Most recently, the middle bridge was closed for two weeks to perform structural steel repairs to the bridge's floor beams. This closure is part of the larger bridge reconstruction project currently ongoing.

1.3 STUDY GOALS/OBJECTIVES

During the study's initial months, a set of goals, objectives, and evaluation criteria were developed and refined in conjunction with the SAG. Goals define the general intentions and purposes for conducting the study based on the issues that have to be addressed. Objectives describe ways that the goals could be accomplished. The evaluation criteria are used to qualitatively and quantitatively measure how well each alternative meets the defined objectives.

The **Goals** of the study include the following:

- Improve vehicular, marine, bicycle, and pedestrian mobility, connectivity, and safety within the study area and region;

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[2] New Bedford-Fairhaven Middle Bridge, Historic American Engineering Record (HAER) No. MA -101 (National Park Service, August 1990). Environmental Assessment: Replacement of the New Bedford-Fairhaven Bridge (USDOT, FHA, Mass DPW, May 1985). Draft Conceptual Alternative Study for the Relocation of the Route 6 Bridge Over New Bedford Harbor. (City of New Bedford, STV Incoroporated, VHB, Inc. December 2004)

- Maximize economic development through replacement or repair of the New Bedford/Fairhaven Bridge; and
- Identify feasible alternatives for short-, medium- and long-term improvements in the corridor.

The **Objectives** of the study include the following:

- Facilitate economic opportunities for water-dependent industries in the New Bedford Harbor upper basin that may result from project alternatives;
- Improve operational speed and reliability of bridge to reduce delay and travel time for vehicular and marine traffic;
- Reduce impacts to local roadway traffic due to bridge span openings;
- Mitigate impacts to marine traffic due to bridge span closings;
- Improve pedestrian and bicycle mobility and connectivity in the corridor and region;
- Minimize potential impacts to the community and environment from selected improvements;
- Support and ensure consistency with established local goals and regional plans; and
- Develop feasible short-, medium- and long-term implementation plans for selected improvements.

1.4 EVALUATION CRITERIA

Evaluation criteria are specific considerations, or measures of effectiveness, used to assess benefits and impacts of alternatives developed during the study. The study's Evaluation Criteria included in Table 1.1 are tied directly to the defined Goals and Objectives.

The Evaluation Criteria listed below include both qualitative and quantitative measures. When possible, qualitative measures will be monetized for comparison across transportation modes and to assess the overall performance of alternatives. All evaluation criteria – containing both quantifiable or more subjective, qualitative measures of effectiveness – will be used to determine the best solutions for the defined goals and objectives.

Table 1.1 Evaluation Criteria

Evaluation Category	Evaluation Criteria
Bridge Operations	
Bridge opening times	Minutes per bridge closure (shortest)
Vertical clearances	Feet of vertical clearance (height for vessels)
Horizontal clearances	Feet of horizontal clearance (width for vessels)
Estimated number of daily bridge openings	Number per day
Long-term reliability risk	Long-term reliability risk

Evaluation Category	Evaluation Criteria
Transportation Impacts & Mobility	
Operational functionality	Corridor intersections level of service (LOS)
Operational functionality	Corridor volume to capacity ratios
Operational functionality	Change in 50th and 95th percentile queues
Travel time	Average roadway travel time along corridor
Travel time	Average roadway delay (regional)
Travel time	Average roadway delay (Route 6)
Travel time	Average transit service delay
Travel time	Average vessel delay
Pedestrian and bicycle mobility and connectivity	Compliance with ADA requirements
Pedestrian and bicycle mobility and connectivity	Bicycle/pedestrian delay
Pedestrian and bicycle mobility and connectivity	Provision of bicycle facilities
Pedestrian and bicycle mobility and connectivity	Provision of pedestrian facilities
Safety	
Vehicular safety	Conformance with AASHTO and MassDOT standards
Vehicular safety	Delay to emergency vehicle access
Pedestrian and bicycle safety	Impact to high volume bicycle and pedestrian locations
Marine safety	Impact to safe navigation
Marine safety	Delay to emergency marine access
Environment	
Environmental impacts	Impact to coastal resources (square feet)
Environmental impacts	Impact to wetland resources (square feet)
Environmental impacts	Impact to natural resources
Environmental impacts	Impact to air quality and greenhouse gases from idling vehicles
Land Use & Economic Development	
Business impact from bridge	Number of businesses impacted
Business impact from bridge	Value of businesses impacted
Business impact from bridge	Number of jobs lost from businesses impacted
Economic benefits from bridge	Shipper cost savings
Community	
Community impacts	Impact to protected and recreational open space
Community impacts	Impact to historical/archeological resources
Community impacts	Impact to cultural resources
Community impacts	Impact to business access
Community impacts	Impact to environmental justice populations

Evaluation Category	Evaluation Criteria
Visual impacts	Visual impacts
Alternative Feasibility	
Cost	Capital costs
Cost	Annual operating and maintenance costs
Construction phase impacts	Construction duration
Construction phase impacts	Impacts to vehicular traffic
Construction phase impacts	Impacts to Marine traffic
Construction phase impacts	Direct impact to abutting land owners/businesses
Construction phase impacts	Indirect impacts to abutting land owners/businesses
Right-of-way impacts	Permanent and temporary right-of-way impacts

1.5 PUBLIC INVOLVEMENT

A Public Involvement Plan was developed at the onset of the project to provide a framework for the study's public outreach activities. The plan is consistent with MassDOT's Accessible Meeting Policy Directive and established public outreach principles and policies. It describes the various communications tools and networks utilized during the study, which includes a Study Advisory Group (SAG), public informational meetings, a project website, and newsletters that are described in more detail below.

1.5.1 Study Advisory Group (SAG)

To guide the study process, a SAG was formed to allow for early and continued involvement from stakeholders at key points in the study process. SAG members represent diverse stakeholder and interest groups, including study area neighborhood associations, bicycling advocates, regional planning and transit agencies, environmental/water resources interests, recreational users, port development interests, and municipal, state and federal government (elected officials and staff). The SAG assisted in the study effort by providing advice and insight on all the study tasks including, but not limited to, knowledge of local issues, identifying deficiencies in the network, and assessing improvement alternatives.

Six SAG meetings were held during the duration of the study process. An initial meeting allowed SAG members to review the study area, goals and objectives, and evaluation criteria. The following two meetings were to review existing conditions and identify issues and constraints. At the fourth meeting, the three identified alternatives were reviewed. The results of the alternatives analysis process was presented and reviewed at the fifth meeting. The draft report including the recommended alternative was discussed at the final SAG meeting.

1.5.2 Public Informational Meetings

In addition to the SAG meetings, three public informational meetings were held at key study milestones. The first meeting was held to review the study area, goals and objectives, and evaluation criteria, as well as the preliminary existing conditions and issues/constraints. The three developed and analyzed alternatives were presented at the second public meeting. The third public meeting was held to present and solicit comments on the draft recommendations.

1.5.3 Project Website

An interactive project website was created to support the other public participation efforts. The website allowed members of the public to follow the progress of the study, obtain meeting dates and materials, and submit comments or questions. The website was updated on a regular basis throughout the study process.

1.5.4 Newsletters/Fact Sheets

Two newsletters were released during the project to provide project updates. The newsletters were distributed electronically to the SAG, members of local boards and commissions, neighbors and abutters, local college communication networks, and the press. The first was released midway through the planning process and the second was distributed at the completion of the draft recommendations.

1.5.5 Media Coordination/Other Communication Networks

Notices for the public informational meetings were distributed via press releases through the MassDOT Office of Public Affairs. Numerous news and media outlets, neighborhood associations, and other groups or locations were included to maximize notification. Additionally, the study team coordinated with the City of New Bedford and Town of Fairhaven's communication networks.

1.5.6 Limited English Proficiency Outreach

To ensure that the study information was available to study area populations with limited English proficiency an analysis was conducted at the initiation of the study to identify non-English languages that are frequently spoken in the study area. An analysis of census data, identified that the largest non-white ethnic group in the the study areas is Hispanic or Latino. Additionally an analysis conducted by SRPEDD in 2013 found that the predominant language spoken by limited English proficient populations in the study area was Portuguese or Portuguese Creole. As such, Portuguese and Spanish language translation were provided at public meetings and for outreach materials for this study.

2 Existing Conditions & Issues

2.1 OVERVIEW

2.1.1 Regional Overview

Located about 50 miles from Boston in southeastern Massachusetts in Bristol County, the New Bedford-Fairhaven Bridge provides a connection between New Bedford to Fairhaven across the New Bedford Harbor. The harbor is part of the Acushnet River estuary, which empties into Buzzards Bay. The area can be accessed via Interstate 195 (I-195), U.S. Route 6 (Route 6), and State Routes 18, 140, and 240.

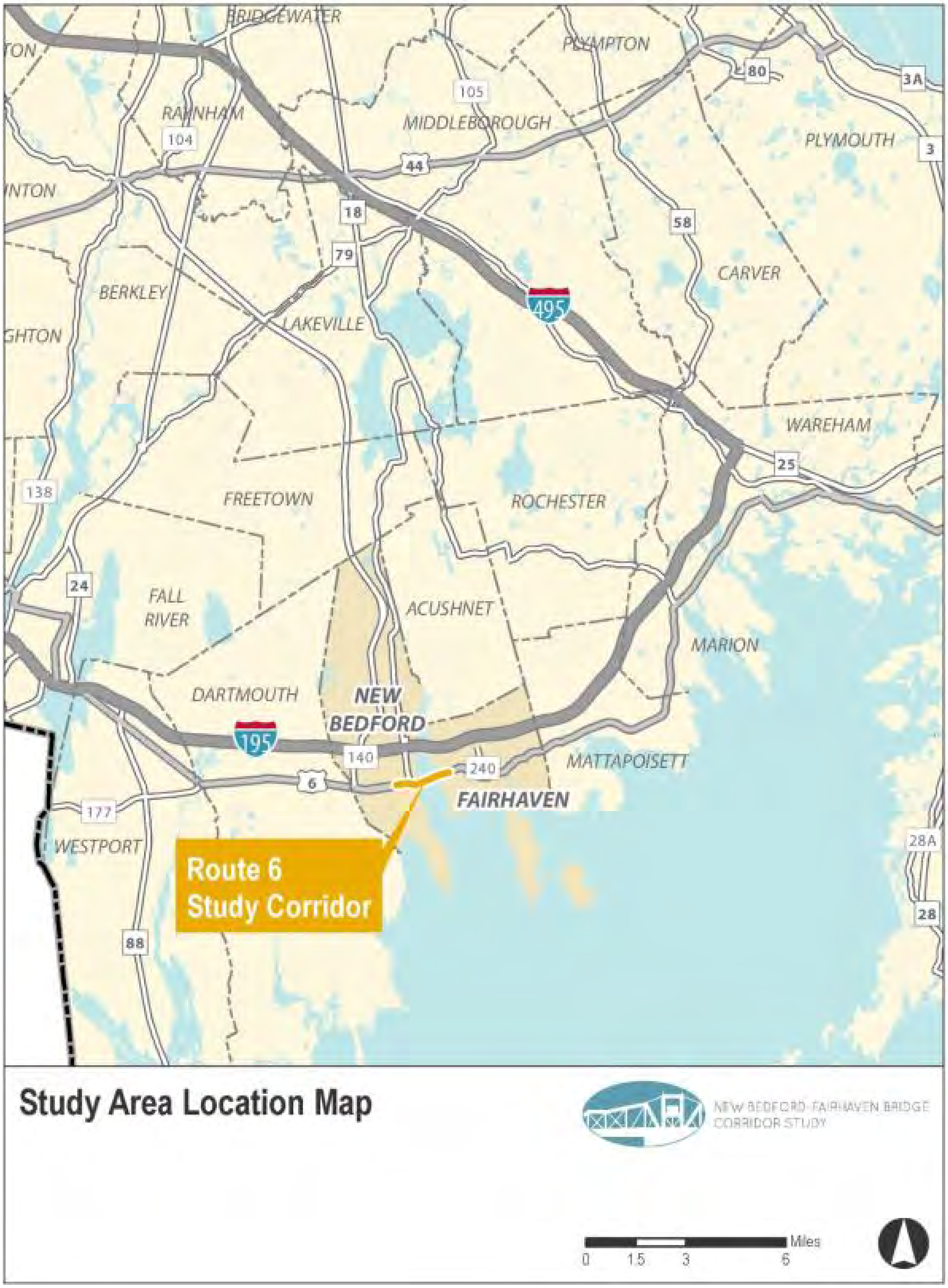
While the majority of the east-west interregional traffic is carried by I-195, Route 6, which crosses the New Bedford-Fairhaven Bridge, is the historic east-west highway in the region. Completed in the 1970s, I-195 now provides access between Providence, Rhode Island; Fall River, Massachusetts; and I-495/Route 25 in Wareham, Massachusetts. Route 140 provides primary north-south access from New Bedford to Taunton where a connection to Route 24 provides the quickest route to Boston. Route 18 provides secondary north-south access and serves as a connector between I-195 and downtown New Bedford. Route 240 is a short highway that serves as a north-south connector between I-195 and Route 6 in Fairhaven.

Route 6 is a four-lane highway that carries mostly local commuter and intra-regional traffic. I-195 and Coggeshall Street are both located approximately one mile north of the New Bedford-Fairhaven Bridge and provide alternative bridge routes. Through New Bedford, Route 6 splits into one-way paired roadways aligned along Mill Street (westbound traffic) and Kempton Street (eastbound traffic). In Fairhaven, Route 6 is aligned along Huttleston Avenue.

The City of New Bedford and Town of Fairhaven are located on Buzzards Bay and connect to the Towns of Acushnet and Freetown to the north, the Town of Mattapoisett to the east, and the Town of Dartmouth to the west. The two municipalities are part of the Providence metropolitan area. New Bedford is the sixth largest city in Massachusetts. The population has declined since a peak in the early part of the twentieth century, but has remained relatively stable for the past several decades with New Bedford and Fairhaven's 2012 populations at 94,952 and 15,893 respectively.

The area's economic history is largely dependent on marine industry. The first economic boom occurred in the 1830's as the whaling industry became the dominant driver of the local industrial economy. As the whaling industry declined during the latter half of the 19th Century, the area's textile industry grew and was able to sustain the area's economy. Beginning in the 1930's, the textile industries moved to the American South and a long period of unemployment, population loss, and economic stagnation began. In the past fifty years, the area's economic base has diversified and the local economy has stabilized. Today, fishing and manufacturing are the area's primary economic drivers, but the healthcare and tourism industries are growing according to a

Figure 2.1. Study Area Regional Map



2008 market and economic analysis conducted for Mass Development and the City of New Bedford. Driven by the scallop market, the Port of New Bedford is a leading commercial fishing port and is the highest-valued fishing port in the nation.

2.1.2 Section Summary

The replacement of the New Bedford-Fairhaven Bridge has been discussed and studied since the 1960s, with several reports, studies, and plans having been completed. These past studies were consulted for the preparation of this existing conditions data, along with new field investigations and data collection efforts. In addition to reviewing these past planning efforts, existing data from various sources was collected and reviewed. Details about the data collection and methodology are included throughout this section.

This section contains an overview of the existing conditions within the Local and Regional Study Areas. The following topics are included:

- Bridge conditions and operations;
- Socio-economic conditions and projections and a review of Environmental Justice (EJ) populations within the study areas;
- Existing land use, zoning, and economic development potential;
- Natural, historic and cultural resources;
- Maritime traffic conditions and projections;
- Vehicular traffic conditions and projections;
- Existing transit service and proposed improvements; and
- Bicycle and pedestrian conditions.

This section also includes a comprehensive inventory and definition of issues based on the existing and future conditions analysis. A set of project constraints related environmental impacts, engineering/design feasibility, business and residential impacts, cost, and other factors were also identified and are included at the conclusion of this section.

2.2 BRIDGE CONDITIONS & OPERATIONS

2.2.1 New Bedford Harbor

Once the center of the world's whaling industry, the New Bedford Harbor is today the busiest port between Boston and Providence, RI and remains one of the country's leading commercial fishing ports. The long history and vitality of the port are demonstrated by the maritime and commercial areas adjacent to the harbor and the proximity and strong ties with the New Bedford Historic District and the historic town center in Fairhaven.

As shown in Figure 2.2, the New Bedford-Fairhaven Bridge divides the harbor into two primary areas. The northern limit of the north harbor is the I-195 Bridge, which is a fixed bridge with an eight-foot navigational under clearance.

Figure 2.2. New Bedford Harbor Map

The hurricane barrier forms the southern limits of the south harbor. Constructed by the U.S. Army Corps of Engineers (USACE) in 1966, the earth-filled barrier was designed to protect the harbor and shorelands from tidal flooding and storm surge during hurricanes. The hurricane barrier has a 150-foot wide opening with gates that can be closed to secure the harbor during flood emergencies.

Between I-195 and the New Bedford-Fairhaven Bridge, the north harbor area is roughly one-mile long. It is approximately three-quarter-miles wide between New Bedford on the western shore and Fairhaven to the east. The south harbor is approximately the same size. The harbor contains numerous islands including Fish Island and Pope's Island, which are connected to each other, New Bedford, and Fairhaven by the New Bedford-Fairhaven Bridge.

A 350-wide federal shipping channel provides access from Buzzards Bay south of the hurricane barrier into the harbor. The USACE maintains the 30-foot deep channel, which extends three and one-half miles from Buzzards Bay to a turning basin just north of the New Bedford-Fairhaven Bridge. The shipping channel narrows from 350 feet to 150 feet at the hurricane barrier. The channel increases in width in the south harbor back to 350 feet and includes additional anchorage and maneuvering areas. At the New Bedford-Fairhaven Bridge, the channel narrows to 94 feet and 95 feet east and west, respectively, of the swing-span center pier. North of the bridge, the federal channel extends around Fish Island. The City of New Bedford maintains the deep-water channel north of the federal channel.

The New Bedford Harbor Development Commission (HDC) is the designated governing agency for the Port of New Bedford. The HDC is responsible for port planning and development, supporting tourism and economic development efforts, ensuring the safety and security of the port, environmental monitoring and management, and coordinating with other agencies and organizations. New Bedford Harbor Master officials act as agents of the HDC and are responsible for the enforcement of harbor regulations. Additionally, New Bedford is a designated U.S. Customs Port of Entry and a Foreign Trade Zone (FTZ).

2.2.2 Existing Bridge

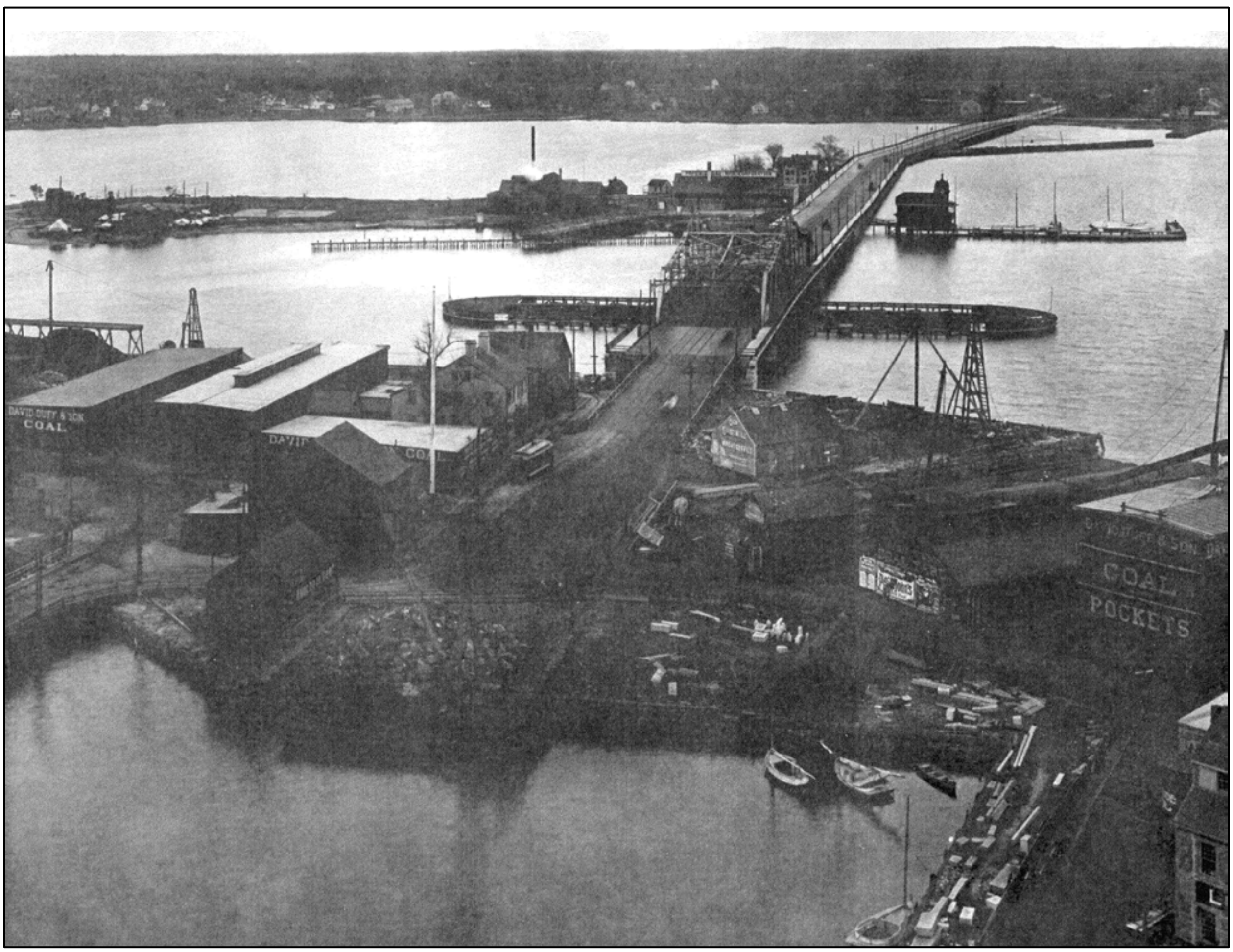
BRIDGE HISTORY

A bridge has connected New Bedford and Fairhaven in the current location for over the last 200 years. The original structure was a 24-foot-wide wooden toll bridge completed by private investors in 1800. This initial bridge was partially destroyed by a wind driven tidal inundation in 1807. The repaired bridge was destroyed in 1815 by a hurricane. A replacement wooden bridge was completed in 1819. This bridge was also a private bridge with two draw spans. By 1869, when the bridge was again severely damaged by a storm, the bridge had been updated with 60-foot wide drawbridge spans. These two drawbridge spans were located between the New Bedford shoreline and Fish Island and between Pope's Island and the Fairhaven shoreline to accommodate larger vessels.

After the 1869 storm, the bridge proprietors decided not to repair the bridge and the Bristol County Commissioners acquired the bridge through an act of the state legislature. The county repaired the bridge in 1870 as a public facility with no tolls. In 1876, the New Bedford and Fairhaven Street Railway Company installed trolley tracks on the bridge to provide horse-drawn passenger service between New Bedford and Fairhaven. The railway introduced electric streetcars in 1893.

By the 1890s, the bridge was experiencing heavier traffic and the condition of the bridge led local officials to begin planning to replace the bridge with a new structure (see Figure 2.3). Several phases of construction on the existing bridge began in 1896. The bridge was completed in 1903. The single swing span of the bridge was placed between Fish Island and Pope's Island, rather than in the two original locations between the New Bedford shoreline and Fish Island and between the Fairhaven shoreline and Pope's Island.

Figure 2.3. New Bedford-Fairhaven Bridge under construction, view from New Bedford



Prior to its first major overhaul in 1931, the Massachusetts Department of Public Works assumed operational responsibility of the bridge from Bristol County. The bridge received minor repairs over the next 30 years, including upgrades to the fender piers, lighting, operator's house, plank decking, and removal of the streetcar tracks.

Since the 1960s, bridge repairs have become more frequent and more significant as vehicular traffic over the bridge increased. In 1961, the deck and deck framing of the fixed spans were replaced. The state legislature authorized a special commission in 1965 to evaluate the feasibility to replace the swing bridge. At the time, and over the past fifty years, replacement of the bridge was deemed cost-prohibitive and rehabilitation projects were performed instead of replacement.

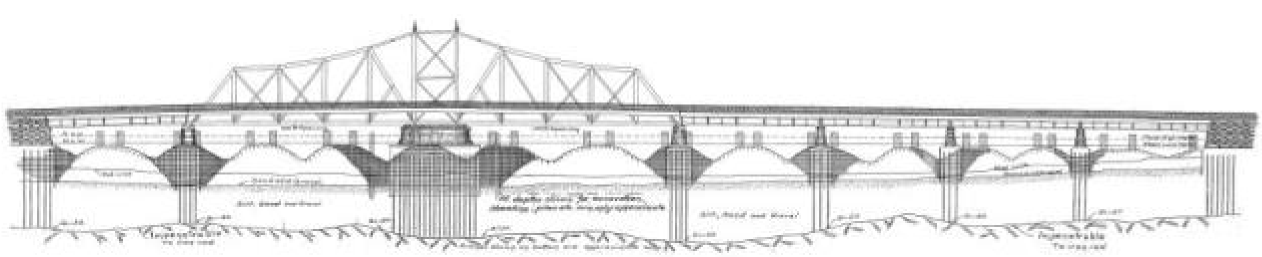
DESCRIPTION OF EXISTING BRIDGE STRUCTURE

The New Bedford-Fairhaven Bridge carries a four-lane highway across the 4,000-foot wide harbor. As previously shown on Figure 2.2, the bridge consists of highway segments on Fish Island and Pope's Island and three separate bridge structures.

The west bridge extends over MacArthur Drive in New Bedford, a single railroad track, and the westerly channel between the shoreline and Fish Island. In addition to carrying Route 6, it includes connecting ramps to Route 18. The west bridge consists of ten spans, six on land, and four over water. The two westerly spans over MacArthur Drive and the rail track are steel stringer construction and were replaced in 1972 when the Route 18 ramps were completed. The remaining eight spans are original steel girder construction. The entire bridge is approximately 580 feet long.

The middle bridge is the segment that contains the swing span. This bridge is composed of one fixed span approach to the west of the swing span and four to the east. All of the spans are the original steel girder construction. The swing span is a 289-foot long rim-bearing truss bridge that rests on a central granite masonry pier. This type of bridge is a load-bearing structure that is comprised of trusses or connected elements that form triangular elements. When in the closed position (closed to marine traffic), the swing span is supported by the center pier and the end abutments. When the bridge is open, the bridge structure is supported by the center pier alone and vessels are able to pass through the two channels (94 and 95 feet) on either side of the center pier. The entire middle bridge is approximately 680 feet long. The approach, the two fixed bridges, and the movable bridge span have four travel lanes and sidewalks on each side.

Figure 2.4. Middle Bridge Cross-Section



Source: New Bedford-Fairhaven Bridge Design Plans, 1927

The east bridge connects Pope's Island to the Fairhaven shoreline. This bridge segment consists of nine spans of the original steel girder construction and is approximately 675 feet long.

2.2.3 Bridge Operations

Based on the 2010 Preliminary Structures Report prepared for the middle bridge, the mechanical and electrical systems for the movable bridge are in good condition. The bridge was closed to vehicular and pedestrian traffic in 2012 for three weeks for additional electrical repairs.

The opening sequence of the bridge follows the American Association of State Highway and Transportation Officials' recommendation and requires approximately four minutes to open and an additional four minutes to close. The average time to open and close the bridge varies and is based on the marine traffic transit time and the time requirement to clear pedestrians and vehicles from the movable span before it can open to marine traffic. As shown in Table 2.1, the average bridge operating cycle is between 12.5 and 22.5 minutes. This compares to 7.5 minutes if the bridge was just opened and closed without having to wait for vehicular, pedestrian, or marine traffic.

As shown in Table 2.2, the bridge operates on a fixed schedule during the daylight hours and on demand at all other times. This schedule results in 4,745 planned openings per year.

Table 2.1. Bridge Operating Cycle

Activity	Duration (minutes)	Variability / Impacts to Duration
Traffic light turns to red	0	
Warning gates close	1-5	Time for pedestrians and bicycles on bridge to clear
Barrier gates close	1	
Span opens	2.5	
Marine traffic passes	5-10	Number and speed of vessels
Span is closed and locked	2.5	
Gates are opened	0.5	
Traffic lights turns to green	0	
TOTAL	12.5-22.5	

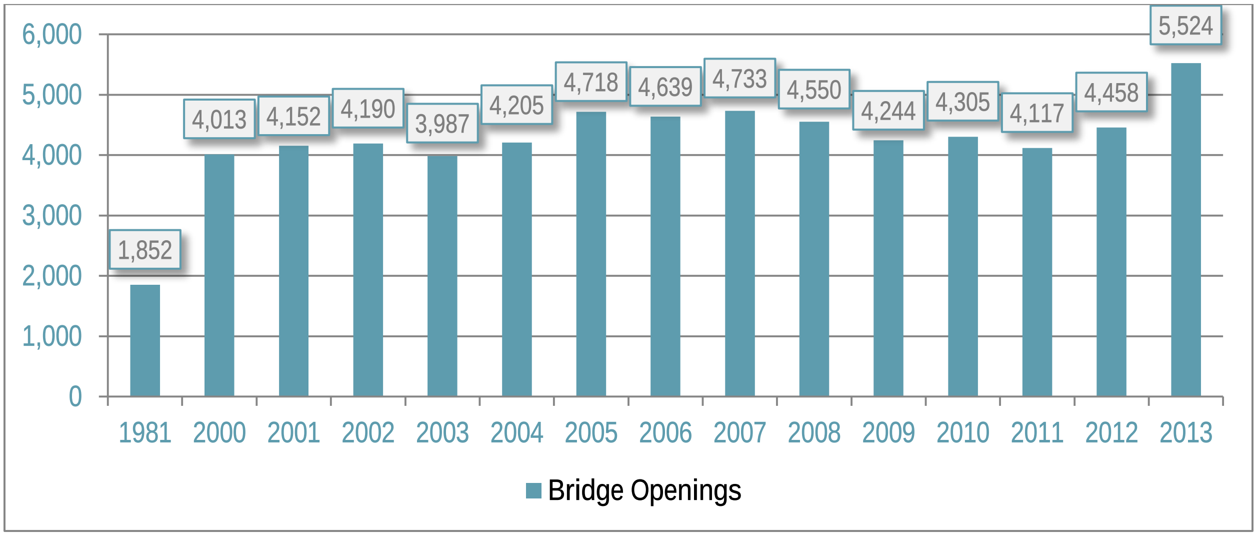
Table 2.2. Bridge Operation Schedule

Early AM	AM	PM	Late PM
On Demand	6:00	12:15	On Demand
	7:00	1:15	
	8:00	2:15	
	9:00	3:15	
	10:00	4:15	
	11:15	5:15	
		6:15	

Historic bridge opening data reveals that the bridge is opening significantly more often than 30 years ago. Figure 2.5 summarizes historic bridge opening data reported in the 1985 *Environmental*

Assessment (1985 EA) and recent bridge openings logs. As shown, the number of bridge openings has significantly increased. In 1981, the bridge opened 1,852 times compared to 5,524 openings in 2013. It is believed that the sharp increase in the number of bridge openings in 2013 is tied to the Environmental Protection Agency (EPA) harbor cleanup. Between 2000 and 2012 the annual number of openings averaged 4,300 (slightly less than the number of scheduled openings).

Figure 2.5. Bridge Openings, Selected Years, 1981 to 2013



Since a significant number of vessels that enter the north harbor are pleasure craft, including sailboats and other small motor boats, the number of bridge openings varies throughout the year. Table 2.3 compares the bridge openings and vessel traffic for four months in 2013, providing a representation of the anticipated patterns and level of vessel traffic in the coming years. Both the number of vessels and the number of openings peak in July. During this month, the bridge opened on average 20 times per day allowing an average of 63 vessels to pass through the bridge. The marine traffic and bridge openings were lowest in January, when an average of only 20 vessels passed through the bridge and only 11 openings.

The duration of the bridge openings is also longer in July. On average, 3.2 vessels passed through the bridge each time it opened during that month. As the number of vessels that pass through the bridge increases, the time required for vessels to pass through the opening increases, consequently increasing the delay for waiting vehicles.

Table 2.3. Bridge Openings and Vessels by Month, 2013

Vessels/Openings	January	April	July	October
Average Daily Vessels	20	23	63	48
Average Daily Openings	11	12	20	18
Average Vessels/Opening	1.9	1.9	3.2	2.7

An evaluation of bridge opening records from 2013 indicates that the bridge opens at all hours of the day. As shown in Table 2.4, bridge openings peak during the middle of the day. Based on the scheduled openings between 6 AM and 6:15 PM and the actual openings during that time period, the bridge opens less during the daytime than what is scheduled. Over one-third of the annual bridge openings occurred on demand between 7 PM and 6 AM.

Table 2.4. Annual Bridge Openings by Time of Day, 2013

Time Period	Bridge Openings	Scheduled Openings
Early AM (12-6am)	992	-
Peak AM (6-9am)	748	1,095
Late AM (9am-12pm)	923	1,095
Early PM (12pm-4pm)	1,181	1,460
Peak PM (4-7pm)	743	1,095
Late PM (7pm-12am)	944	-
TOTAL OPENINGS	5,531	4,745

2.2.4 Bridge Inspections

Over the past 50 years, the New Bedford-Fairhaven Bridge has been either repaired or rehabilitated approximately on a 12-year cycle. Based on similar bridges, this repair history is typical of movable bridges located over tidal waterways. Based upon the 2013 National Bridge Inspection Standards (NBIS) inspection report and the HDR cursory inspection (2014) the bridge can be maintained in a reliable operating state over the next 50 years. However, the costs will increase as more elements of the structure deteriorate. To achieve this state of reliable operation, the current level of maintenance currently performed needs to be maintained and specific structural, mechanical, and electrical repairs will need to be implemented. The superstructure truss is a pin and eye-bar design (obsolete) that will continue to require close monitoring and repair of the pin/eye-bar connections.

The 2013 NBIS inspection results indicated that the superstructure condition varies between seven (very good) and five (fair). NBIS inspection ratings can vary from nine, which means the bridge is in excellent condition to one, which means there is major deterioration and imminent failure and zero which is a bridge that is beyond repair and is typically out of service. The structure was painted in 1997 and has signs of minor paint failure and corrosion. Some web members, cover plates, and rivets show corrosion and section loss. These elements can be repaired and spot painting can be performed. Corrosion and pack rust at the upper tread plate is the most significant structural defect which is expensive to correct and will remove the bridge from operation over a one to two month period.

The mechanical system was rehabilitated and is in good condition (rated as a seven), with the exception of the tread plate, and selected rollers within the drum girder system. The electrical system was rehabilitated and is functioning well with the exception of limit switch failures. These nuisance maintenance issues could be reduced by installing redundant limit switches.

2.3 SOCIO-ECONOMIC CONDITIONS

2.3.1 Existing Demographics

Located about 30 miles southeast of Providence, RI in Bristol County, MA, the City of New Bedford and Town of Fairhaven are part of the greater Providence metropolitan area. The two municipalities are also located within Massachusetts' Southeastern Regional Planning and Economic Development (SRPEDD) region and the Providence-Warwick, RI Metropolitan Statistical Area.

Population in New Bedford peaked during the early part of the 20th century, but as textile industries relocated outside the city in the 1930s, population declined. Over the past several decades, the population has been relatively stable. According to the U.S. Census Bureau's 2008-2012 American Community Survey (ACS) Five-Year Estimates, the 2012 population for New Bedford was 94,952. The Town of Fairhaven is a much smaller municipality, with an economy tied to New Bedford across the harbor. Like its neighbor to the west, Fairhaven's population has also remained relatively stable for the past 40 years. In 2012, the population was 15,893. Within the Local Study Area, the population in 2012 was 17,654. The Regional Study Area population was 54,905 persons in 2012, roughly half of the New Bedford and Fairhaven combined population.

According to 2012 employment figures from the Massachusetts Executive Office of Labor and Workforce Development (EOLWD), the total number of jobs in the City of New Bedford was 36,899 compared to 7,200 in the Town of Fairhaven. Approximately 14 percent of the jobs in the two municipalities are located within the Local Study Area and 32 percent within the Regional Study Area. The primary industries for employment in New Bedford are health care and social assistance (21 percent), manufacturing (17 percent), and educational services (eight percent). In Fairhaven, the leading industries for employment were health care and social assistance (24 percent), retail trade (16 percent), and accommodation and food services (12 percent). Forestry, fishing, and hunting accounted for 1.9 percent of all jobs in Fairhaven and 2.6 percent of jobs in New Bedford.

The City of New Bedford has a higher rate of unemployment compared to other local municipalities, the region, and the state. According to the 2008-2012 ACS Five-Year Estimates, the unemployment rate in New Bedford was 11.7 percent in 2012. Comparatively, the unemployment rate in Fairhaven was 8.3 percent, 10.4 percent in Bristol County, and 8.5 percent in Massachusetts.

2.3.2 Environmental Justice Populations

BACKGROUND

Title VI of the Civil Rights Act of 1964 specifies that no person in the United States shall, on the grounds of race, color, or national origin be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.

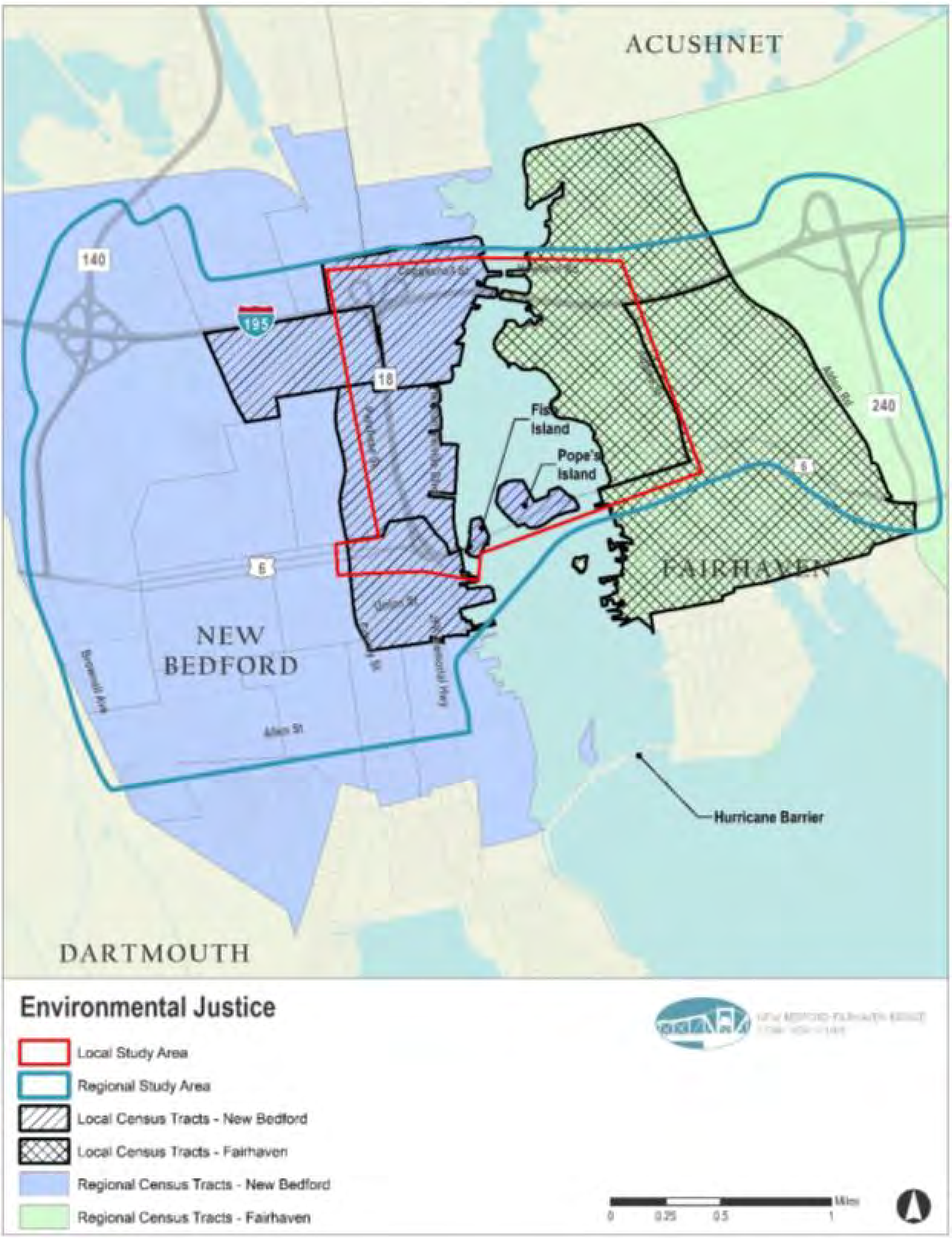
Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, issued in 1998, states that each federal agency shall make achieving environmental justice (EJ) part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. Executive Order 13166 was signed into law on August 11, 2000. It requires Federal agencies to examine the services they provide, identify any need for services to those with Limited English Proficiency (LEP), and develop and implement a system to provide those services so LEP persons can have meaningful access to them.

METHODOLOGY

To evaluate the study corridor for the purposes of EJ, 2008-2012 ACS Five-Year Estimates were used to determine the presence and locations of minority and low-income populations within the study corridor. The data collection effort focused on the census tracts (survey areas for the Census) that fall entirely or partially within the study areas. These are shown in Figure 2.6 below. The data analysis considered the two study areas as a whole as well as individual census tracts in each.

Two complementary methodologies were considered when identifying possible EJ populations in the study corridor. The first was the U.S. Council on Environmental Quality (CEQ) guidance. The CEQ identifies an EJ group where the proportion (percentage) of the minority or below-poverty population in an area is "meaningfully greater" than the percentage in the broader (larger) area. Under the CEQ methodology, minority populations are those that classify themselves as any race except white. The current U.S poverty level as determined by the U.S Department of Health and Human Services for a family of three is $19,790 per year. The median household size for the Regional Study Area is 2.6. Thus, the poverty threshold for this analysis was rounded to $20,000 per household (HH).

Figure 2.6. Study Area Census Tracts



The second method of identifying the locations of any EJ populations in the study area was to consider the thresholds for identifying EJ populations within the State of Massachusetts and the planning region, which encompasses New Bedford and Fairhaven. These include:

- Massachusetts Executive Office of Energy and Environmental Affairs (Mass EEA) EJ Criteria:
  - Income: 25 percent or more of households earn 65 percent or less of the Massachusetts median household income
  - Minority: 25 percent or more of residents identify as a race other than white
  - English Language Isolation: 25 percent or more of HH have no one over the age of 14 who speaks English only or very well
- Southeastern Massachusetts MPO (Southeastern Regional Planning and Economic Development District or SRPEDD) Title VI Plan
  - Minority and low income areas are evaluated by census tracts; if the category exceeds the average for the region then the tract is considered either a minority or low-income area
  - Limited English Proficiency (LEP): languages other than English are spoken by more than 1,000 people or five percent of the total population

For this study, an EJ population is therefore defined based on consideration of the above methodologies, and taking the more conservative approach, reflecting the Massachusetts state-level criteria. For this study, EJ populations include any of the following:

- Minority: 25 percent or more of residents identify as a race other than white;
- Low-Income: 25 percent or more of HH earn 65 percent or less of the MA median household income ($65,339); or $42,470 or less; or
- LEP: 25 percent or more of the HH have Limited English Proficiency as identified by ACS data.

ENVIRONMENTAL JUSTICE POPULATIONS IN STUDY AREA

Figure 2.6 below shows the location of EJ populations in the study area. Maps showing the total population, as well as concentrations of minority, low-income, and LEP populations for the two study areas, are included in Appendix D. Figure 2.6 indicates that:

- The area of New Bedford within the Local Study Area is home to EJ populations. All of the census tracts exceed the threshold for both minority and low-income percentages.
- The majority of the area of New Bedford within the Regional Study Area contains EJ populations. Eleven of 18 census tracts exceed one or more EJ thresholds.
- In Fairhaven, one EJ threshold is exceeded (at or below 65 percent of the MA median HH income) in both census tracts within the Local Study Area; the Regional Study Area in Fairhaven does not have any notable areas of EJ populations.

Some of the EJ populations in New Bedford and Fairhaven occur in neighborhoods along the shoreline of the Acushnet River and are in close proximity to the New Bedford-Fairhaven Bridge.

Environmental Justice is considered to be a concern for project impacts when the percentage of EJ populations in an area is "meaningfully greater" than that in a larger related geographic area. For this study, the concentration of EJ populations in the two study areas was compared to the following geographies: City of New Bedford, Town of Fairhaven, Bristol County, SPREDD Region, and State of Massachusetts. Table 2.5 summarizes the comparative EJ population data for these geographies.

The information in Table 2.5 is also shown and summarized in Figure 2.7 below. The information in the table and map suggests that EJ is a concern for the local and regional study areas in New Bedford based on the presence of concentrations of both minority and low-income populations. It is a concern for the Local Study Area in Fairhaven as well.

It is interesting to note that the percentage of LEP populations is substantially lower in the study areas as a whole than the percentage of minority populations. Yet, the LEP populations in all of the New Bedford study area census tracts exceed the Massachusetts EOEEA threshold of five percent or greater, while none of the Fairhaven census tracts in the study areas exceed the threshold. Yet, those census tracts which occur in New Bedford along the shoreline and adjacent to the bridge do not meet the second Massachusetts EOEEA threshold of LEP populations of 1,000 or more persons.

This finding informed the community outreach efforts for this study. Notably, under Title VI of the Civil Rights Act of 1964 and Commonwealth Executive Order 526, MassDOT must ensure that programs and activities do not discriminate based on race, color or national origin, age, disability and sex, among other protected categories. The agency's Accessible Meeting Policy provides guidance to ensure that MassDOT includes Title VI constituencies in transportation programs and activities. The method for determining whether and/or what non-English languages need to be translated, calls for an analysis of the number of limited English proficiency persons by language group where a meeting will be held, the frequency of contacts with the program, the importance of the program and cost factors. The largest non-white ethnic group identified in the ACS data for the study areas is Hispanic or Latino. An analysis conducted by SRPEDD in 2013 found that the predominant language spoken by LEP populations in the study area was Portuguese or Portuguese Creole (8.75 percent of those who are LEP the Regional Study Area). As such, Portuguese and Spanish language translation were provided at public meetings and for outreach materials for this study.

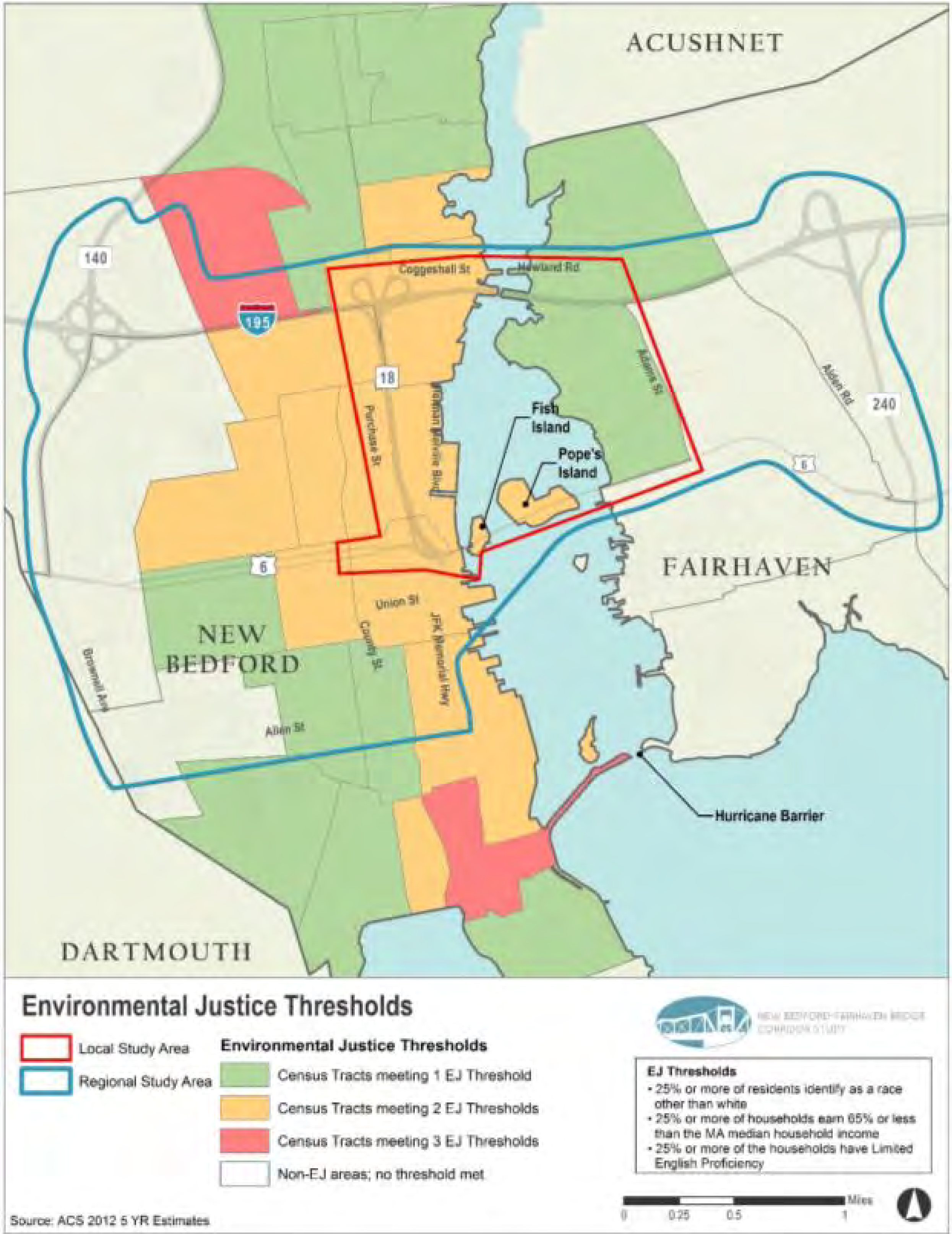
Table 2.5. Environmental Justice Population by Census Tract, 2012

Geography by Census Tract	Total Population	Percent Minority	Percent Below Poverty	Above or Below 65% of Median HH Income for MA	Percent LEP
Fairhaven Local Study Area Total	7,852	6.1	14.5		2.9
25005655200	4,410	9.4	18.7	Below	2.5
25005655300	3,442	2.9	10.2	Below	3.3
New Bedford Local Study Area Total	9,802	36.5	40.8		11.6
25005651100	3,838	42.2	41.1	Below	13
25005651300	2,203	27.9	30.4	Above	6.3
25005651200	2,165	46.3	49.5	Below	15.7
25005651800	1,596	29.4	42	Below	11.3
Fairhaven Regional Study Area Total	11,818	4.9	11.6		3.1
25005655200	4,410	9.4	18.7	Above	2.5
25005655100	3,966	2.4	6	Above	3.6
25005655300	3,442	2.9	10.2	Above	3.3
New Bedford Regional Study Area Total	51,419	29.2	27.4		13.7
25005651002	4,048	17.6	15.1	Above	7.3
25005651600	4,600	39.1	18.5	Above	11.9
25005652300	3,255	16.3	13.9	Above	20.4
25005652200	3,164	14.8	8.2	Above	6.9
25005651001	2,830	8.7	8.2	Above	8.7
25005652100	2,647	12.9	17.3	Above	6.6
25005650800	3,004	24.7	28.2	Below	19.9
25005651500	3,301	32.6	21.6	Above	11.7
25005651100	3,838	42.2	41.1	Below	13
25005652000	2,675	19.4	21.2	Above	21
25005651400	3,036	31.0	17	Above	12.5
25005650900	2,813	36.4	48.2	Below	27.6
25005651300	2,203	27.9	30.4	Above	6.3
25005650700	2,073	29.4	32.7	Above	19
25005651700	2,178	43.5	39.1	Below	10.7
25005651200	2,165	46.3	49.5	Below	15.7
25005651800	1,596	29.4	42	Below	11.3

Geography by Census Tract	Total Population	Percent Minority	Percent Below Poverty	Above or Below 65% of Median HH Income for MA	Percent LEP
25005651900	1,993	53.1	41.3	Below	15.7
Town-wide Totals					
Fairhaven	15,893	4.1	9.8	n/a	2.5
New Bedford	94,952	22.9	23.5	n/a	14.2
Regional Totals					
SRPEDD Region	110,845	19.2	7.4	n/a	12.9
Bristol County	548,739	10.5	12.4	n/a	7.9
State	6,560,595	19.0	11.4	n/a	6.7

Source: 2008-2012 ACS Five-Year Estimates

Figure 2.7. Environmental Justice Thresholds



2.3.3 Population/Employment Projections

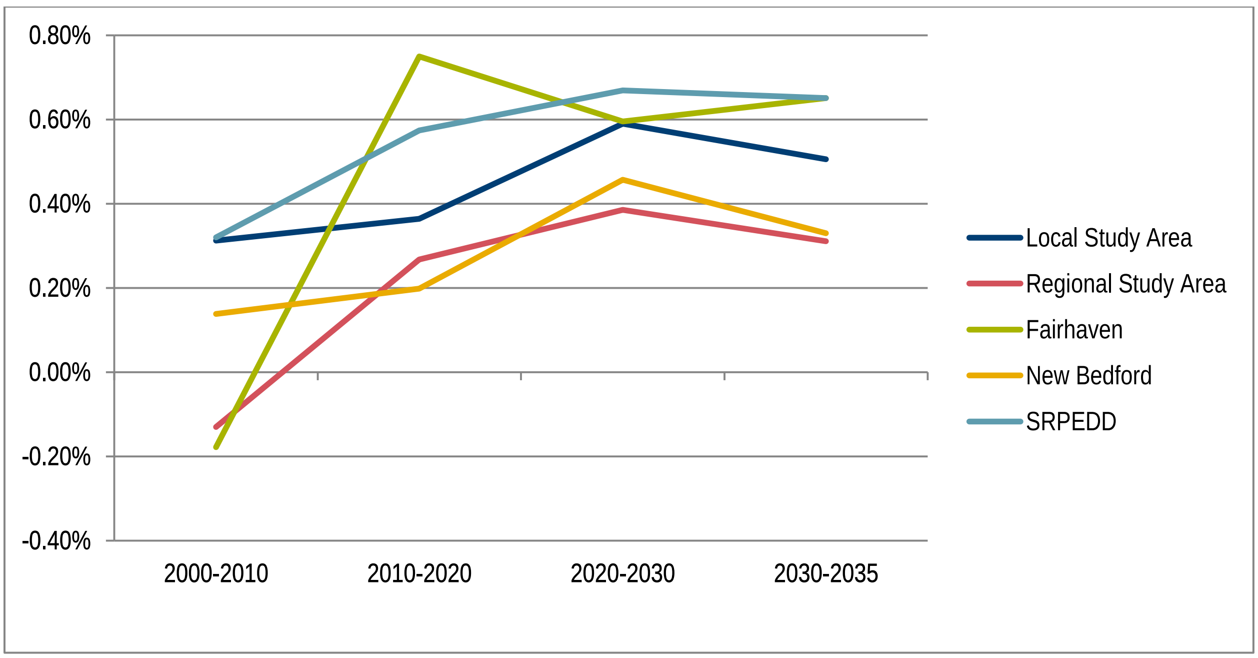
METHODOLOGY

To compare the future population and employment within the study areas, population and employment estimates for 2010 and projections for 2020, 2030, and 2035 from SRPEDD Regional Transportation Demand Model Traffic Analysis Zone (TAZ) data were obtained. The Local Study Area and Regional Study Area estimates and projections were determined by aggregating data for the TAZs that are located completely or mostly within each of the two study areas. For the Local Study Area, this included six TAZs (256, 257, 258, 266, 278, and 279) in New Bedford and three TAZs (259, 282, and 283) in Fairhaven. In addition to these nine TAZs, the Regional Study Area also included an additional 31 TAZs (217 to 223, 229 to 230, 234 to 249, 252, 260 to 262, and 264 to 265) in New Bedford and two additional TAZs (296 and 298) in Fairhaven.

POPULATION PROJECTIONS

Although population within the Regional Study Area and the Town of Fairhaven declined between 2000 and 2010, SRPEDD projections indicate a modest increase over the next twenty years in both of the study areas, New Bedford, Fairhaven, and the SRPEDD region in general. The Regional Study Area and New Bedford in general have the lowest annual rate of growth over the entire period. Figure 2.8 shows the projected population annual growth rate and Table 2.7 includes total population figures for each of the five areas.

Figure 2.8. Population Projected Annual Rate of Growth



Source: U.S. Census Bureau, 2000 and 2010 Census; SRPEDD, Regional Transportation Demand Model population projections

Table 2.6. Population Projections, 2020 to 2035

Area	Population 2000	Population 2010	Population 2020	Population 2030	Population 2035
Local Study Area	8,301	8,564	8,881	9,419	9,659
Regional Study Area	42,369	41,821	42,951	44,635	45,332
Fairhaven	16,159	15,873	17,103	18,148	18,746
New Bedford	93,768	95,072	96,971	101,490	103,175
SRPEDD	597,294	616,670	653,000	698,000	720,999

Source: U.S. Census Bureau, 2000 and 2010 Census; SRPEDD, Regional Transportation Demand Model population projections

EMPLOYMENT PROJECTIONS

Employment estimates for 2000 were not available on the TAZ level, so estimates could not be aggregated for the Local and Regional Study Areas. Employment projections for the Regional Study Area and New Bedford show a modest decline in employment between 2010 and 2020, but a similar annual rate of growth between 2020 and 2030. Employment growth in all areas is expected to slow between 2030 and 2035. Table 2.7 includes total employment figures for each of the five areas and the percent rate of growth.

Table 2.7. Employment Projections, 2020 to 2035

Area	Employment 2010	Employment 2020	Employment 2030	Employment 2035	Rate of Growth 2010-2020	Rate of Growth 2020-2030	Rate of Growth 2030-2035
Local Study Area	5,855	5,918	6,324	6,409	0.11%	0.67%	0.27%
Regional Study Area	13,331	13,243	14,134	14,247	-0.07%	0.65%	0.16%
Fairhaven	6,022	6,053	6,459	6,513	0.05%	0.65%	0.17%
New Bedford	36,147	35,829	38,241	38,467	-0.09%	0.65%	0.12%
SRPEDD	227,838	243,000	260,000	265,000	0.65%	0.68%	0.38%

Source: U.S. Census Bureau, 2000 and 2010 Census; SRPEDD, Regional Transportation Demand Model population projections

2.4 LAND USE/ECONOMIC DEVELOPMENT

2.4.1 Existing Land Use

LAND USE PATTERN

At the center of the Local Study Area is the New Bedford Harbor, which is fed by the Acushnet River to the north and empties into Buzzards Bay to the south.

As shown in Figure 2.9, the primary existing land uses in the New Bedford portion of the Local Study Area are industrial and commercial. Marine industries are concentrated along the waterfront and supporting uses are located on adjacent parcels. The proposed South Coast Rail Whale's Tooth Station is located near the maritime uses in New Bedford. The Hicks-Logan-Sawyer District is also located in the northwestern corner of the Local Study Area.

The two islands along Route 6 within the local study areas are both within the City of New Bedford. Pope's Island is a combination of commercial, industrial, open space, and marina uses, while Fish Island is completely occupied by industrial uses. In Fairhaven, the existing land use is predominantly residential in the local study area, but some, with some open space and marina uses adjacent to the waterfront.

Approximately 1,800 parcels are located within the Local Study Area, split almost equally between New Bedford and in Fairhaven. Twenty properties within the Local Study Area are adjacent to the bridge approaches and could potentially be affected by bridge replacement or other improvements. These properties are located in New Bedford along the waterfront and on Fish and Pope's Island. A summary of the ownership, size, and existing use of these properties is provided in Table 2.8. The parcels are shown on Figure 2.9.

ZONING

The zoning in both New Bedford and Fairhaven is consistent with the existing land uses and supports the continuation of waterfront industrial, industrial, and mixed-use business uses in New Bedford, and residential uses in Fairhaven. As shown in Figure 2.11 the waterfront parcels on the New Bedford shoreline and Fish Island are primarily Waterfront Industrial (WI). Parcels on Pope's Island are zoned Industrial A (IA) or Residential A (RA). The waterfront parcels are also within the Working Waterfront Overlay District.

Parcels between Herman Melville Boulevard and Route 18 are zoned Industrial A or Industrial B. The Industrial B zone is generally more restrictive in the diversity of permitted commercial uses in the district. The Wamsutta Mill Overlay District includes the parcels between Wamsutta Street, North Front Street, Acushnet Avenue, and Logan Street. West of Route 18 and south of Route 6, the parcels located within the Local Study Area are zoned Mixed Use Business (MUB), Residential A (RA), or Residential B (RB), with the Residential B zone allowing two family residential dwellings. The Downtown Business Overlay District (DBOD) extends into the southwest corner of the Local Study Area. The overlay districts are not shown on Figure 2.11.

Figure 2.9. Existing Land Use Map

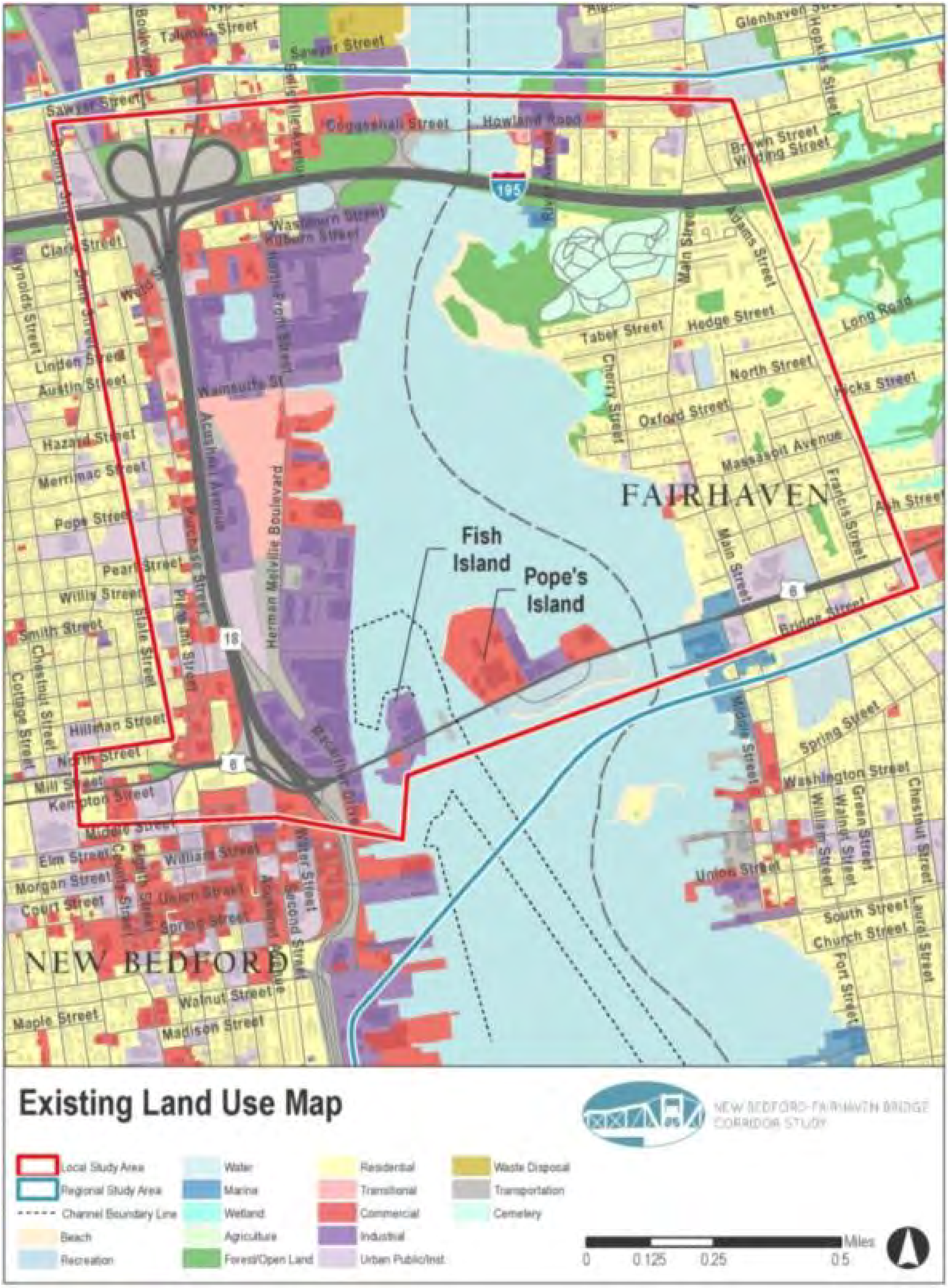
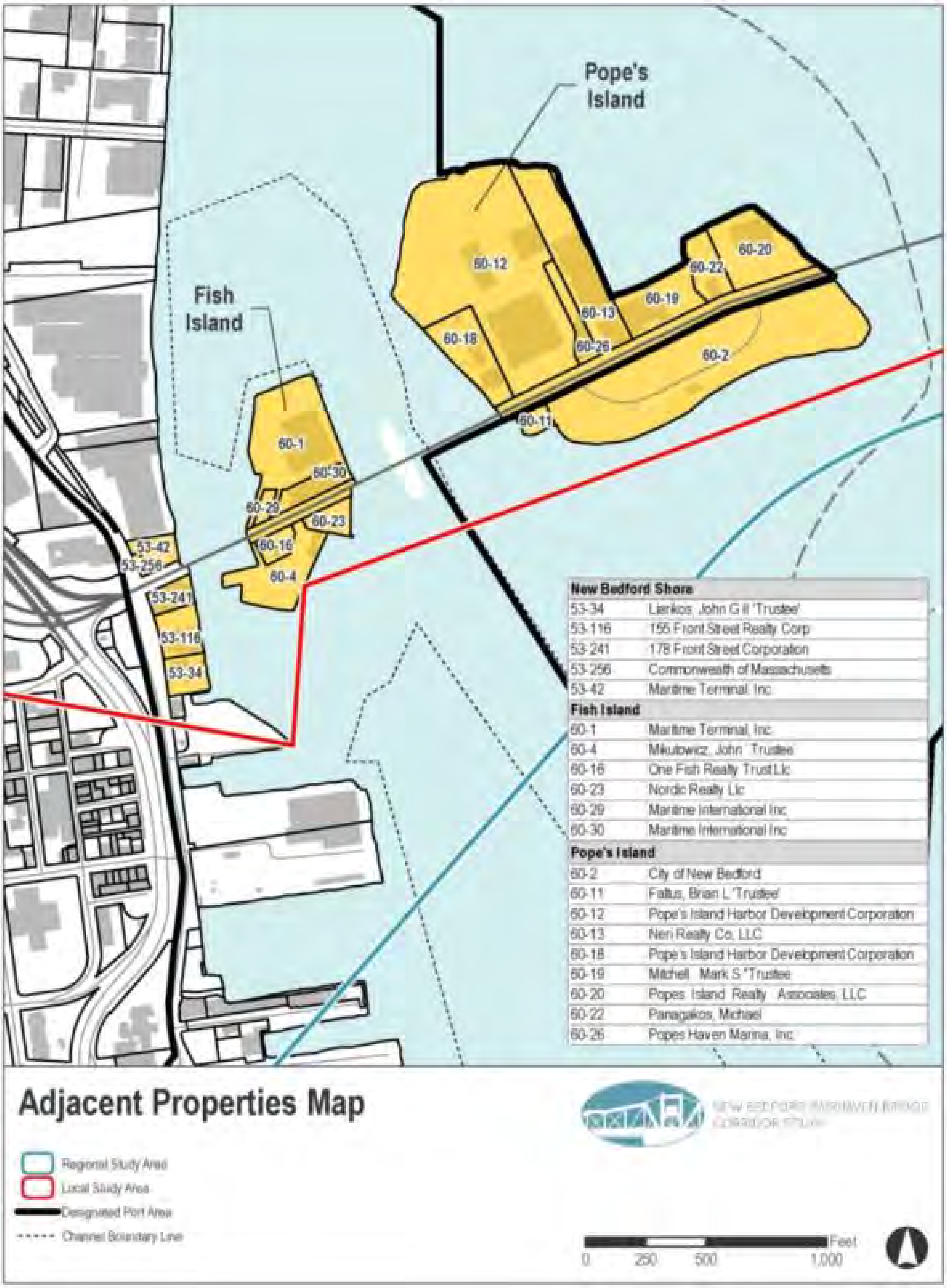


Table 2.8. Adjacent Properties

Parcel ID #	Owner	Occupant	Current Use	Acres
53-34	Liarikos, John G II 'Trustee'	Global Co-Op Wharf	Fuel Service Areas	0.667
53-116	155 Front Street Realty Corp	Crystal Ice	Buildings for manufacturing operations	0.852
53-241	178 Front Street Corporation	Crystal Ice	Buildings for manufacturing operations	0.526
53-256	Commonwealth of Massachusetts	Unoccupied	Massachusetts Highway Department	0.079
53-42	Maritime Terminal, Inc.	Maritime Terminal	Land - integral part of manufacturing operation	0.521
60-1	Maritime Terminal, Inc.	Maritime Terminal	Warehouses for storage of manufactured products	3.108
60-4	Mikutowicz, John `Trustee`	AGM Marine Contractors, Inc.	Office Building - part of manufacturing operation	1.600
60-16	One Fish Realty Trust LLC	Fish Island Gas	Gasoline Service Stations	0.401
60-23	Nordic Realty LLC	Tucker Roy Marine Towing & Salvage	Developable Industrial Land	0.464
60-29	Maritime International, Inc.	Maritime Terminal	Developable Industrial Land	0.169
60-30	Maritime International, Inc.	Maritime Terminal/Northern Pelangic Group LLC	Buildings for manufacturing operations	0.623
60-2	City of New Bedford	Marine Park	Improved, Selectmen or City Council (Municipal)	9.725
60-11	Faltus, Brian L 'Trustee'	Captain Leroy's	Marinas	0.211
60-12	Pope's Island Harbor Development Corporation	The Bridge Shoppes (Worleybeds Factory Outlet, Bob's Sea and Ski, Cape Cod Billiards & Dart Supply, Precision Orthotics)	Shopping Centers/Malls	10.570
60-13	Neri Realty Co, LLC	Unoccupied Building	Buildings for manufacturing operations	3.011
60-18	Pope's Island Harbor Development Corporation	Bridge Shoppes Marina (Niemiec Marine, CMS Fishing Tackle, Niemiec Yacht Sales, Fathoms)	Small Retail and Services stores (under 10,000 sq. ft.)	1.485
60-19	Mitchell Mark S "Trustee	Whaling City Marina, Rick's Outboard Marine, R.A. Mitchell Co.	Buildings for manufacturing operations	1.559
60-20	Popes Island Realty Associates, LLC	Fairhaven True Value Hardware	Facilities providing building materials, hardware , equip, etc.	1.980
60-22	Panagakos, Michael	Dunkin Donuts, Newsbreak	Eating and Drinking Establishment	0.775
60-26	Popes Haven Marina, Inc.	Temptation	Eating and Drinking Establishment	0.652

Source: MassGIS Level 3 Assessors' Parcel Data (October 2013)

Figure 2.10. Adjacent Properties Map



New Bedford Shore	
53-34	Lerikos, John G II 'Trustee'
53-116	155 Front Street Realty Corp
53-241	178 Front Street Corporation
53-256	Commonwealth of Massachusetts
53-42	Maritime Terminal, Inc
Fish Island	
60-1	Maritime Terminal, Inc
60-4	Mikutowicz, John 'Trustee
60-16	One Fish Realty Trust Llc
60-23	Nordic Realty Llc
60-29	Maritime International Inc
60-30	Maritime International Inc
Pope's Island	
60-2	City of New Bedford
60-11	Faltus, Brian L 'Trustee'
60-12	Pope's Island Harbor Development Corporation
60-13	Neri Realty Co, LLC
60-18	Pope's Island Harbor Development Corporation
60-19	Mitchell, Mark S 'Trustee
60-20	Popes Island Realty Associates, LLC
60-22	Panagakos, Michael
60-26	Popes Haven Marina, Inc

Parcels located within the Local Study Area in the Town of Fairhaven are primarily zoned Single Residence (RA). Marsh Island is zoned Agricultural (AG). There are some isolated pockets of Business (B) and Apartment/Multifamily (RC) within the Local Study Area.

DESIGNATED PORT AREA

As shown on Figure 2.11, a portion of New Bedford-Fairhaven Designated Port Area (DPA) extends into the Local Study Area. The DPA includes waterfront parcels south of Wamsutta Street and east of Herman Melville Boulevard and MacArthur Drive, Fish Island, and the northern half of Pope's Island. Along with 10 other DPAs in Massachusetts, state policy seeks to "preserve and enhance the capacity of the DPAs to accommodate water-dependent industrial uses and prevent significant impairment by non-industrial or non-water-dependent types of development, which have a far greater range of siting options."

The Massachusetts Office of Coastal Zone Management (CZM) is responsible for supporting planning to promote maritime development, prevent user conflicts, and accommodate supporting industrial and commercial uses. The Massachusetts Department of Environmental Protection (DEP) is responsible for permitting uses, fill, and structures in DPAs.

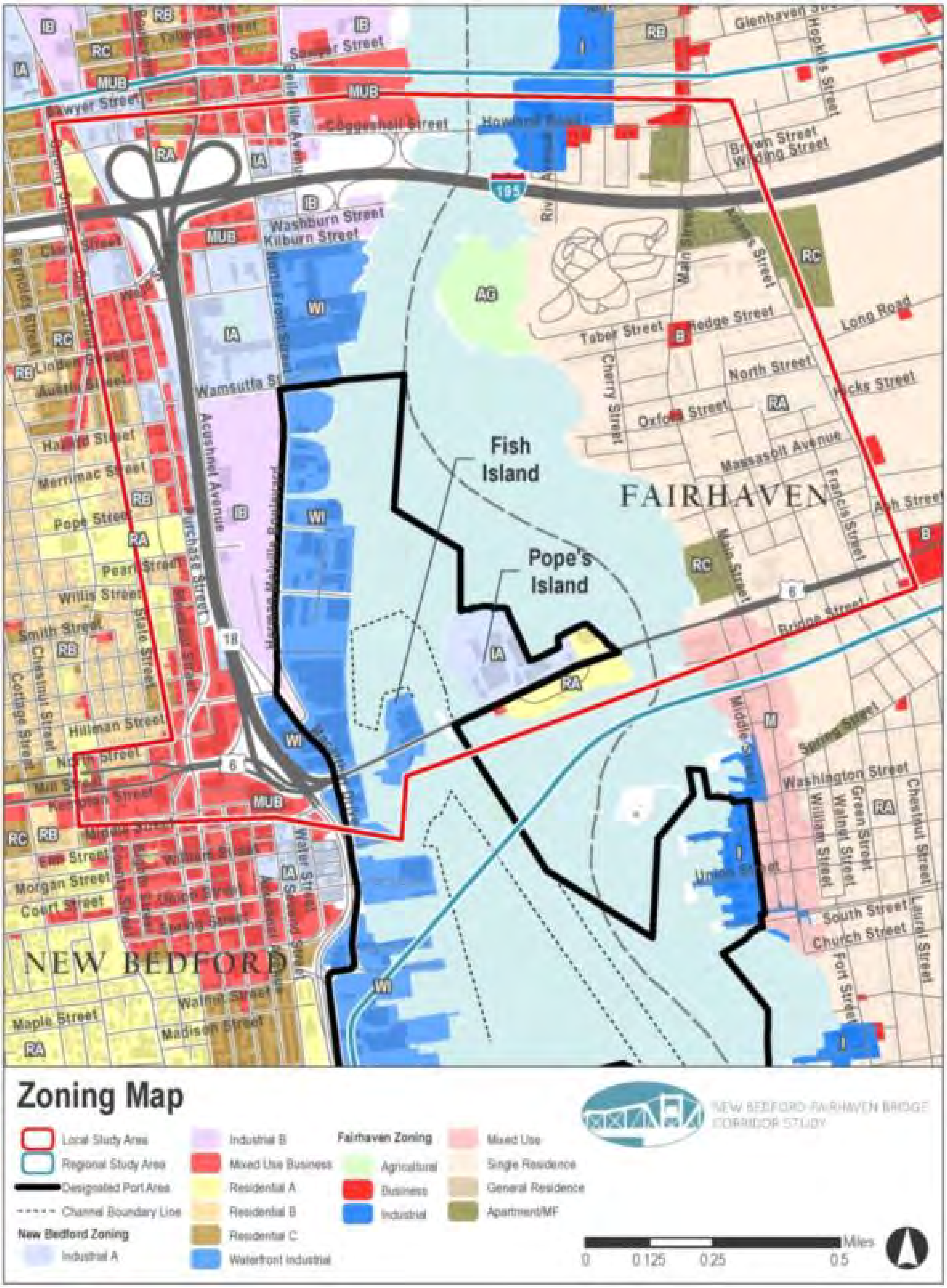
Completed in 2010, the *New Bedford/Fairhaven Municipal Harbor Plan* (Harbor Plan) is the state-approved plan for New Bedford Harbor. The plan includes the DPA master plan and outlines the ongoing dredging process established through the State Enhanced Remedy (SER) and the location of the Confined Aquatic Disposal (CAD) sites in the harbor. The 2010 plan differs from the previous 2002 plan that supported the removal of the middle bridge and the construction of a new bridge from Wamsutta Street to Pope's Island. The 2010 plan proposes a double bascule bridge in the current alignment to increase the bridge opening from the current effective width of 90 feet to a new width of 150 feet.

ACCESS AND CIRCULATION

In addition to the New Bedford-Fairhaven Bridge and Route 6, the primary east-west corridors in the Local Study Area are I-195 and Coggeshall Road/Howland Road. Route 18 is the principal north-south roadway in New Bedford. Within the Local Study Area, Herman Melville Boulevard and MacArthur Drive provide access to the waterfront parcels in New Bedford and Main Street and Adams Street provide north-south access in Fairhaven.

As shown in the 2006 *SRPEDD Hurricane Evacuation Route Evaluation*, several roadways within the Local Study Area are designated hurricane evacuation routes. The New Bedford-Fairhaven Bridge is not a designated hurricane route, but Route 6 east and west of the harbor is a designated route. The plan identified that, as of the date of the plan, 2006, the west and east bridges were structurally deficient. In Fairhaven, Route 240, Main Street, and Adams Street are designated hurricane routes. JFK Memorial Highway, Rt. 18, County Street, MacArthur Drive, Herman Melville Boulevard, Acushnet Avenue, and Rt. 140 are designated hurricane routes in New Bedford. I-195 is the principal east-west evacuation route.

Figure 2.11. Zoning Map



Both New Bedford and Fairhaven provide fire and emergency services to their respective municipalities. In case of bridge closure, Pope's Island could receive service from Fairhaven via the east bridge. St. Luke's Hospital in New Bedford is the only facility in the two municipalities that provides emergency services. Bridge closures could affect Emergency Medical Services (EMS) access to the hospital from Fairhaven.

In case of emergency in the north harbor area, the New Bedford-Fairhaven Bridge impedes emergency boat access. The bridge must open to allow municipal police, fire and rescue, harbormaster, or other emergency response vessels to transit the bridge.

PUBLIC OFF-STREET PARKING FACILITIES

As described in the 2010 Harbor Plan, public parking to serve waterfront uses is provided on city-owned land on and adjacent to the Gifford Street Boat Ramp, the Pease Park Boat Ramp, the Pope's Island Marina, Fisherman's Wharf, Homer's Wharf, Leonard's Wharf and at State Pier. In addition, the HDC operates a remote parking facility (the Whale's Tooth Parking Lot in the Hicks-Logan-Sawyer District) and runs a shuttle bus between parking and the Fast-Ferry terminal at State Pier. These parking areas currently provide adequate parking associated with vessels, seafood processors, various marine industrial uses, and other waterfront uses including the Bourne Counting House and Wharfinger Building. The Elm Street Garage also provides public parking in the general waterfront area and is located right next to the New Bedford Whaling National Park. As additional development occurs, it is critical to balance parking needs with the development of this area. In the long term, the Harbor Plan recommends a structured parking lot so that parking needs can continue to be met in the future.

MAJOR UTILITIES

The following utilities are located along the New Bedford-Fairhaven Bridge:

- **Water**. A 12-inch water main runs from the New Bedford mainland to Fish Island, Pope's Island, and finally to the Town of Fairhaven. The water main is attached to the west and east bridges, but runs under water between Fish Island and Pope's Island. The underwater portion of the pipeline runs south of the swing bridge and is about three feet below the harbor bottom.
- **Gas**. NSTAR provides gas service to Pope's Island from the Fairhaven mainland. The service is provided via a 4-inch intermediate-pressure main. Fish Island does not have gas service.
- **Electricity**. Electric service is provided to Pope's and Fish islands by NSTAR through underground conduits and mains attached to the west and east bridges. Pope's Island is provided service from Fairhaven and Fish Island is provided service from New Bedford. No electric lines run between the islands.
- **Telecommunications.** Nine major telephone cables that provide service to the towns east of New Bedford and to the Cape Cod area cross the harbor between New Bedford and Fairhaven. Five cables cross to Fish Island on the west bridge, run along the harbor bottom south of the middle bridge to Pope's Island, and cross to Fairhaven

over the east bridge. Four other submarine cables begin at the New Bedford mainland just south of Fish Island and run either to Pope's Island (one cable) or to Fairhaven (three cables).

2.4.2 Economic Development

The City of New Bedford has long held global significance in the fishing industry, and its port has been the nation's most profitable port by catch value for over a decade straight. The Port of New Bedford drives New Bedford's economy as a whole. Improvements to the New Bedford-Fairhaven Bridge to support the strengthening of the local fishing industry could also provide opportunities for more diverse economic development within the port and the surrounding area.

EXISTING PLANS & GUIDING DOCUMENTS

Future development of the Port of New Bedford, including the area around the New Bedford-Fairhaven Bridge, is guided by several existing plans and documents. Figuring prominently in the guidance of this study, the City of New Bedford and Town of Fairhaven's 2010 *New Bedford/Fairhaven Municipal Harbor Plan* (Harbor Plan) aims to promote and implement the community's planning vision for its waterfront area. The plan also provides information to guide state agency decisions needed to place the plan into action. The four overriding community goals that guided this plan's development are: 1) to support traditional harbor industries, 2) to rebuild and add to the harbor infrastructure, 3) to capture new opportunities for the expansion of marine and related supporting industries, and 4) to enhance the harbor environment.

The MassDOT's *Ports of Massachusetts Strategic Plan* (Ports Strategic Plan) is intended to enhance coordination between relevant regulatory agencies in order to bring a "collaborative approach to the planning, design, funding, construction, operation, and maintenance of the Commonwealth's water-based transportation and waterfront port facilities." The Strategic Plan, which was under development in 2013, seeks to organize the Commonwealth's port system in a way that provides better, interconnected service to meet the differing needs of port customers and a regional economy. Details about existing port conditions from the Ports Strategic Plan Tech Memo 4: Analysis of the Massachusetts Ports System was considered as part of this section.

Completed in 2008 by the City of New Bedford, the *Hicks-Logan-Sawyer Master Plan* was also taken into consideration. This plan guides the development for this important mixed-use waterfront neighborhood in New Bedford located adjacent to the North Harbor and within the Local Study Area. The plan identifies existing conditions, strengths, weaknesses, and opportunities to help this neighborhood to reach its development potential.

Lastly, MassDOT's 2010 *Massachusetts Freight Plan* (Freight Plan) was developed in accordance with the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), which was the federal surface transportation authorization act governing federal transportation spending at the time it was developed. The plan is multi-modal and intermodal in scope, and provides a comprehensive evaluation of the Commonwealth's freight transportation system, its operations, and its effect on economic development and quality of life. The Freight Plan prescribes several scenarios for investment in key infrastructure areas, one of which, the "South Coast Multimodal Freight Improvements" scenario, ties in strongly with the proposed improvements for the New Bedford-Fairhaven Bridge. This scenario calls for bridge improvements for better truck access to the Ports of New Bedford and Fall River, expanded harbor dredging, enhanced railway capacity, improvements and expansions of existing marine terminals, and expanded inland transload and distribution center operations to handle, warehouse and exchange goods between rail and truck. Viewed as a complete package, the South Coast Multimodal Freight Improvements are expected to increase cargo traffic in the region by 7,370 tons annually per $1 million of investment, with a positive overall return on investment.

COMMERCIAL FISHING & SUPPORTING INDUSTRIES

The Port of New Bedford reports that over 4,400 people are employed within the commercial port. In 2011, per the National Oceanic and Atmospheric Administration (NOAA), the New Bedford fishing fleet landed over 117 million pounds of products, with $369 million in direct sales, making it the top port in the U.S. for total sales for twelve consecutive years. Scallops are a particularly valuable catch in which the Port of New Bedford specializes. While fishing has been extremely important to the New Bedford area, it is also an industry that fluctuates with both the regulatory environment of the time, and with the existing local fish stock.

The Freight Plan estimates that, on average, each incoming vessel load at the port creates $100,000-150,000 in direct economic impact, including an average of 30 longshoremen for off-loading, and 20 teamsters for warehouse transit. Each shipment brings approximately 100-150 truckloads of product.

In addition to direct commercial fishing activity, the Port has extensive refrigeration and processing/handling facilities available to support both the fishing industry and cargo shipments, with 4.5 million cubic feet of cold storage and excellent distribution and warehousing facilities. As noted in the 2010 Massachusetts Freight Plan The harbor is host to an already substantial seafood processing industry, with 25 wholesale and 35 processing operations, and is poised to continue to grow. By improving port access, the demand for seafood processing operations will undoubtedly increase; the Port of New Bedford has the expertise, equipment, and available space to accommodate continued growth in this highly important complementary industry. Increasing the port's ability to accept incoming fish creates a direct local economic impact by increasing demand for employment in the processing industry.

CARGO OPERATIONS

The Port of New Bedford traffics a significant amount of cargo. The majority of outbound domestic commercial vessels ship sand and gravel, with 240,429 short tons leaving from the Port in 2008. This particular commodity accounts for approximately 70 percent of total freight volume that moves through the port. Most freight traffic comes or goes to other US ports, accounting for about 90 percent of the total freight moved through the Port of New Bedford (*MA Freight Plan*).

The majority of foreign inbound freight originates in Canada. This freight is primarily petroleum and non-metallic minerals, and usually constitutes between 50,000 and 100,000 short tons of freight for the Port in a given year. Other imports that arrive through the port are mainly perishable agricultural commodities, such as fruits and nuts. These loads are brought in" break-bulk" form and primarily originate from Morocco. Packaged cargo, such as those in crates or barrels and put on pallets (but not containerized) is typically called "break-bulk" cargo. Break-bulk cargo is the only type that can currently be supported at the existing North Harbor terminal facilities.

The port also handles a small but notable amount of international export tonnage per year. This tonnage is primarily break-bulk cargo and consists mainly of fresh and frozen fish destined for northern Europe, and household goods bound for Africa and Cape Verde (*MA Freight Plan*).

EXISTING PORT ADVANTAGES

New Bedford already has the infrastructure setup to expand its cargo operations. The harbor itself is well protected from surges by its hurricane barrier. The port enjoys unencumbered deep-water access, and widespread refrigeration and warehouse capacity. Extensive navigational dredging has recently taken place in the harbor, improving water quality and allowing the port to continue to accept larger vessels that cannot be accommodated by most other ports in New England. The port has a Foreign Trade Zone (FTZ), which is particularly important for sustaining freight operations and provides an incentive for future growth. Goods in the FTZ can be assembled, manufactured, or processed, and final products re-exported, without paying Customs duties. The Port of New Bedford also notes that commercial use of the port is also exempt from the Harbor Maintenance Tax, a federal tax imposed on shippers based on the value of imported goods being shipped through a particular port. These factors provide the port with a considerable competitive advantage, offering a potential cost advantage for foreign businesses considering trade in U.S. markets.

The Port of New Bedford also benefits from great access to a diverse and growing transportation network. Trucking rates are significantly lower in New Bedford as compared to other major regional ports like Boston, New York, and Philadelphia (*MA Freight Plan*). According to the Port of New Bedford, the port offers a shorter distance to many end-destinations, provides access to New England, the greater Northeast, and southern Canada markets, and offers an alternative that avoids major bottlenecking intersections along the I-95 Corridor.

Significant area for redevelopment exists within the entire Port of New Bedford. Within the North Harbor area, improving the bridge could encourage business development throughout the entire harbor. North of the bridge, there are approximately 65 acres of land within the Designated Port Area. The majority of this area is currently used for marine industrial uses, including fish and seafood processing facilities, warehouses, and marine terminals. Existing businesses include:

- Maritime Terminals (8.1 acres including parcels on Fish Island),
- American Seafoods International (8.9 acres),
- Eastern Fisheries (6.8 acres),
- Big G Seafoods (0.9 acres),
- JC Fisheries (0.7 acres),
- Atlantic Red Crab Company
- M&B Sea Products (1.5 acres),
- SeaWatch International (4.8 acres) and,
- PPC Packaging (1.7 acres).

Other uses include a holding area for sand and other materials that are shipping via barge, electrical and welding businesses that support the fishing industry, and a restaurant.

This area also includes the North Terminal area, a 10-acre facility with a range of existing uses. The North Terminal Area could accommodate a laydown and open storage area. Part of the area is owned by the City of New Bedford and the HDC has plans to rehabilitate and add five additional acres of usable land. Plans include dredging and fill, addition of a new pier, and adding rail spurs allowing for additional vessel/rail connections.

2.5 NATURAL/CULTURAL/HISTORIC RESOURCES

2.5.1 Natural Resources

The following sections provide a description of the existing natural resources found within the New Bedford-Fairhaven Bridge Corridor Local Study Area. Existing natural resources were evaluated using Massachusetts Geographic Information Systems (MASSGIS) data. The boundaries of the Local Study Area and the location of the existing natural resources, relative to the New Bedford-Fairhaven Bridge are presented on Figures 2.12 and 2.13.

WETLANDS

The Massachusetts Wetlands Protection Act (WPA) (M.G.L. c. 131, § 40) serves to identify eight "public interest" functions that wetland areas provide, and it establishes regulations and performance standards to protect these functions. Any activity that will potentially affect a wetland area is to be regulated in order to contribute to the following interests:

- Protection of public and private water supply
- Protection of groundwater supply
- Flood control
- Storm damage prevention
- Prevention of pollution
- Protection of land containing shellfish
- Protection of fisheries
- Protection of wildlife habitat

On coastal lands subject to the WPA (land under the ocean, coastal banks, coastal beaches and tidal flats, coastal dunes, barrier beaches, rocky intertidal, salt marshes, land under salt ponds, Designated Port Areas, land containing shellfish, and land on the banks of fish runs) activities are approved, prohibited, or conditioned based on their effects on wetland functions and the public interests listed above. Review is required for any activity that will remove, fill, dredge or alter any wetland resource area—with “alter” being defined to include (among other things) the changing of certain habitat-related conditions, such as vegetation, water flow patterns or flushing characteristics, and/or the physical, biological, or chemical characteristics of receiving waters (e.g., temperature, salinity, and biological oxygen demand).

MASSGIS data were used to evaluate the presence of wetlands within the study area. There are several areas of Massachusetts Department of Environmental Protection (DEP)-designated wetlands throughout the Local Study Area. In the northern portion of the study area, close to the I-195 bridge, coastal bank bluff/sea cliff wetlands are located on the eastern shores of New Bedford Harbor, while rocky intertidal shore can be found for a considerable length of the western shores of the harbor. Additionally, several areas of salt marsh wetlands are located on the eastern shores of New Bedford Harbor, towards the mid- and northern-portions of the Local Study Area. Open water and tidal wetlands are also located within the study area. A large area of coastal dune borders the Riverside Cemetery and New Bedford Harbor; this area is located in the northern portion of the study area, and not within close proximity to the New Bedford-Fairhaven Bridge.

Closer to the New Bedford-Fairhaven Bridge tidal flat wetlands lay north of the bridge on the Fairhaven side. On Pope’s Island, rocky intertidal shore can be found north of the bridge while coastal bank bluff/sea cliff wetlands are located south of the bridge, along the southern border of the island.

COASTAL ZONE

The Coastal Zone Management (CZM) Act of 1972 (16 U.S.C. 1451), as amended, and its implementing regulations (15 CFR 930), require all projects located within the designated coastal zone of a state to be consistent with the state's federally approved CZM plan. Section 307 of that act instructs federal agencies not to take action until they have received written certification from the applicant and the state CZM agency, signifying that the proposed project is consistent with the state's coastal zone management plan.

The Massachusetts Office of Coastal Zone Management is the lead policy and planning agency on coastal and ocean issues within the Executive Office of Energy and Environmental Affairs (EEA). CZM receives annual federal grant funds from the National Oceanic and Atmospheric Administration (NOAA) as authorized by the Coastal Zone Management Act. The current *Massachusetts Office of Coastal Zone Management Policy Guide - October 2011* (Policy Guide) is the official statement of the Massachusetts coastal program policies and legal authorities, especially as they relate to the process of federal consistency review. The Policy Guide provides the official program policies of the Massachusetts coastal program—as administered by the Massachusetts Office of CZM—and includes information on the federal Coastal Zone Management Act, the history and operation of the Massachusetts coastal program, federal consistency review, and the application of coastal policy in other state regulatory programs.

Figure 2.12. Natural Resources Map

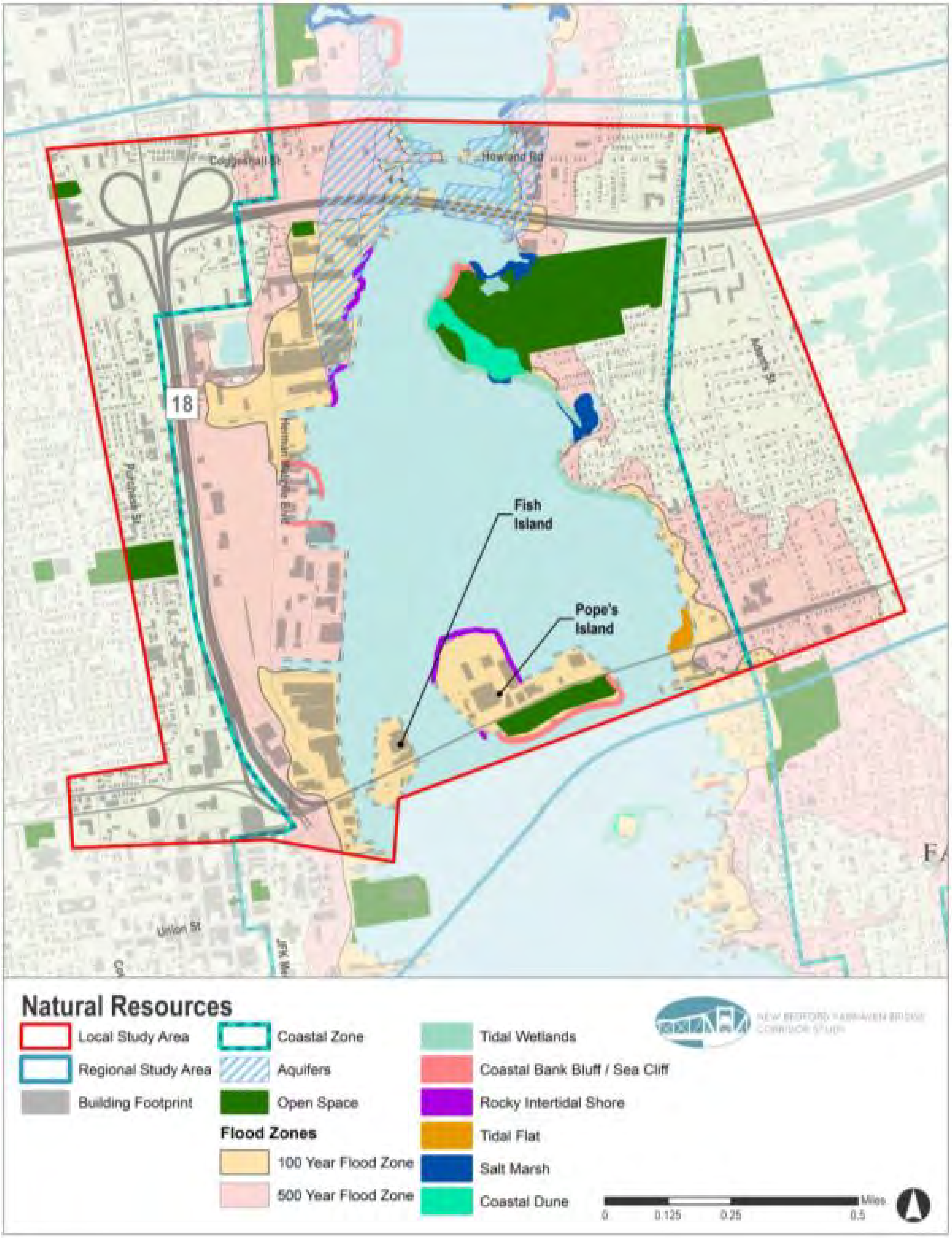


Figure 2.13. Coastal Resources Map

The New Bedford-Fairhaven Bridge falls within Massachusetts' coastal zone and contains the following coastal resources:

- Tidal flats wetlands;
- Rocky intertidal shores wetlands;
- Coastal bank bluff/sea cliff wetlands;
- Open water wetlands;
- Tidal wetlands;
- Salt marsh wetlands;
- Coastal dune;
- Designated Port Area (DPA); and
- Massachusetts Department of Environmental Protection (MassDEP) Chapter 91 Jurisdiction Tidelands.

Per the 2011 Policy Guide, New Bedford Harbor has been identified as a DPA. This definition is used to identify areas that have particular physical and operational features important for water-dependent industrial uses—such as commercial fishing, shipping, and other vessel-related marine commercial activities—and/or for manufacturing, processing, and production activities that require marine transportation or need large volumes of water for withdrawal or discharge. The boundary of the New Bedford-Fairhaven DPA is shown on Figure 2.13. The 2010 Harbor Plan was prepared in accordance with Municipal Harbor Planning (MHP) regulations (301 CMR 23.00) to provide comprehensive planning for the New Bedford-Fairhaven DPA. The plan was approved in 2010.

The Commonwealth's primary tool for protection and promotion of public use of its tidelands and other waterways is Massachusetts General Law Chapter 91, the waterways licensing program of the Public Waterfront Act. Chapter 91 regulates activities on both coastal and inland waterways, including construction, dredging and filling in tidelands, great ponds and certain rivers and streams.

Through Chapter 91 (c.91), the Commonwealth seeks to preserve and protect the rights of the public, and to guarantee that private uses of tidelands and waterways serve a proper public purpose. While other agencies, including the Department of Environmental Management, Massachusetts Office of Coastal Zone Management and the Division of Fisheries and Wildlife, play a role in preserving public rights in public trust lands, the Waterways Regulation Program, the section of MassDEP that oversees Chapter 91, is the primary division charged with implementing the "public trust doctrine." Specifically, the MassDEP Waterways Regulation Program:

- Preserves pedestrian access along the water's edge for fishing, fowling and navigation and, in return for permission to develop non-water dependent projects on Commonwealth tidelands, provides facilities to enhance public use and enjoyment of the water.

- Seeks to protect and extend public strolling rights, as well as public navigation rights.
- Protects and promotes tidelands as a workplace for commercial fishing, shipping, passenger transportation, boat building and repair, marinas and other activities for which proximity to the water is either essential or highly advantageous.
- Protects Areas of Critical Environmental Concern, ocean sanctuaries and other ecologically sensitive areas from unnecessary encroachment by fill and structures.
- Protects the rights of waterfront property owners to approach their property from the water.
- Encourages the development of city and town harbor plans to dovetail local waterfront land use interests with the Commonwealth's statewide concerns.
- Assures removal or repair of unsafe or hazardous structures.

The MassDEP Waterways Regulations (310 CMR 9.02) define tidelands as "present and former submerged lands and tidal flats lying between the present or historical high water mark, whichever is farther landward, and the seaward limit of state jurisdiction." Sites located seaward of the contiguous line are presumed to be in c. 91 jurisdiction. The approximate c. 91 Tidelands Jurisdiction is shown on Figure 2.13.

COASTAL STORM PROTECTION AND SEA LEVEL RISE

In 1966 a system of improvements were made in New Bedford to provide protection against hurricanes. The system's main feature is the barrier extending across New Bedford Harbor which consists of a 4,500-ft-long earthfill dike with stone slope protection. According to a report titled *Hurricane Barriers in New England and New Jersey – History and Status After Four Decades* prepared by the USACE in 2007, the barrier has a maximum elevation of 20 feet and a 150-foot wide gated opening to accommodate commercial and recreational navigation.

The design of the project was based on a hurricane modeled after the September 1944 hurricane which, at the time, had the greatest energy of any known hurricane along the Atlantic coast. The impacts of a storm of that size was transposed along the Atlantic Coast to model a "direct hit" to New Bedford. The transposed storm was moved northerly with a forward speed of about 40 knots along a critical track creating sustained winds of 100 miles per hour (mph) from due south at New Bedford Harbor. Within New Bedford Harbor, a tide surge associated with this design hurricane was computed to be 13.3 feet. This surge was added to the mean spring high water elevation of 2.7 feet-National Geodetic Vertical Datum (NGVD), resulting in a 16 feet-NGVD elevation above conditions if there were no storm waves present. It was further determined that wave heights associated with this storm would be on the order of about 9 feet for all south facing structures. Therefore, the top of barrier elevation of the navigation gates was set to 20 feet-NGVD. A 16 feet-NGVD elevation is slightly greater than the 500-year tide level. This design also included coincident Standard Project Flood occurrence along the Acushnet River behind the barrier, which has a drainage area of 29.4 square miles.

More recently, in June 2014, the Buzzards Bay National Estuary Program completed a *Climate Change Vulnerability Assessment and Adaptation Planning Study for Water Quality Infrastructure in New*

Bedford, Fairhaven, and Acushnet to document the risks and impacts that may associated with sea level rise and a failure of the hurricane barrier. The study modeled hypothetical worst-case inundation scenarios using a combination of hurricane parameters and sea level rise scenarios, and used the model results to conduct a vulnerability analysis of water quality infrastructure, public property and populations, in particular Environmental Justice populations.

The results of the vulnerability analysis showed that hurricane barriers around New Bedford Harbor began to be compromised by Category 2 hurricanes with 4-foot sea level rise and Category 3 hurricanes at current mean higher high water (MHHW), or the average of the highest high tides. According to the 2014 National Climate Assessment, prepared by the U.S. Global Change Research Program a 1 to 4 foot sea level rise is projected by 2100. At a Category 3 storm with 4-foot sea level rise, maximum inundation depths in the area would reach 32 feet. This scenario would also result in inundation at the project site along with 100 percent of the Designated Port Area, 36 percent of publically owned structures in the area, 26 pump stations, and one wastewater treatment facility. It would also affect more than 30,000 residents of environmental justice communities. Damage quantification analyses were estimated at $3.5 billion in economic damages to buildings and substantial damage to 1,399 buildings.

FLOODPLAINS

As shown on Figure 2.12, the span of the New Bedford-Fairhaven Bridge is located entirely within a 100-year flood zone; this area is also inclusive of Pope's Island, Fish Island, and the New Bedford Harbor to the northern edge of the study area. Portions of the study area are also located within the 500-year flood zone including:

- a large area on the east side of the New Bedford Harbor between and including the southern Local Study Area boundary and the Route 6 approach to the bridge; and
- a large area on the west side of the New Bedford Harbor between the southern Local Study Area boundary and Route 18 to the northern Local Study Area boundary.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN

No known Areas of Critical Environmental Concern (ACEC) are located within the Local Study Area. ACECs are places in Massachusetts that receive special recognition because of the quality, uniqueness and significance of their natural and cultural resources. These areas are identified and nominated at the community level and are reviewed and designated by the state's Secretary of Energy and Environmental Affairs. ACEC designation creates a framework for local and regional stewardship of critical resources and ecosystems.

HAZARDOUS AND CONTAMINATED MATERIALS

New Bedford Harbor has been designated by the U.S. Environmental Protection Agency (EPA) as a Superfund Site and is currently undergoing clean up. According to EPA's web site, New Bedford Harbor is an 18,000-acre urban estuary with sediment highly contaminated with polychlorinated biphenyls (PCBs) and heavy metals; the contamination includes the harbor bottom for about six miles from the New Bedford Harbor into Buzzards Bay. The harbor was placed on EPA's National Priorities List in 1982, and continues to require significant time and funding to clean up.

To date, EPA has removed more than 230,000 cubic yards of contaminated materials from New Bedford Harbor through the hydraulic dredging and filtering process. The contaminated sediments are being placed in Confined Aquatic Disposal (CAD) cells. These man-made CAD cells are created by digging into the harbor floor. Contaminated sediments from the harbor are deposited within the CAD cell, which is then capped once the sediment has time to consolidate. The contaminated sediment is held in place by existing clean sediments on the sides and bottom of the cell and the cap on the top. EPA estimates that clean-up efforts will continue for another five to seven years.

AQUIFERS

Four aquifers are located in the northern portion of the Local Study Area near the I-195 bridge and bordering the New Bedford Harbor on the east and west sides. The aquifers have been classified by MASSGIS as high- and medium-yield aquifers, conducting greater than 300 and between 100 and 300 gallons per minute (gpm), respectively. There are no known aquifers in the immediate vicinity of the New Bedford-Fairhaven Bridge.

SHELLFISH AND FISH HABITAT

According to the MASSGIS data, the waters and flats of the New Bedford Inner Harbor of the New Bedford Harbor, including all waters surrounding the New Bedford-Fairhaven Bridge, have been designated as shellfish growing areas. However, due to the continued clean-up of New Bedford Harbor from extensive PCB contamination, the Massachusetts Department of Public Health (MDPH) prohibits the consumption of any fish or shellfish caught within the New Bedford Inner Harbor area. As part of the continued clean-up efforts in New Bedford Harbor, EPA monitors PCB levels in locally caught fish and shellfish on an annual basis.

PRIORITY HABITATS

No known priority habitats are located within the Local Study Area.

SOILS

The soils surrounding the New Bedford-Fairhaven Bridge, including Pope's Island and Fish Island, are characterized by MASSGIS as Urban Land where much of the land has been disturbed and is covered by structures or pavement; these soils are not considered prime farmland soils.

NOISE

As shown in Figure 2.9 earlier in this section, land uses within the Local Study Area vary within each community, but can be characterized as mostly residential, commercial, and industrial. Noise sensitive receptors are considered to include homes, schools, public parks, and places intended for quiet such as churches and cemeteries. Potential sensitive noise receptors, or those land uses that may be more sensitive to fluctuations in noise levels, have not been identified through a formal noise study. However, potential sensitive noise receptors within close proximity to the bridge, as observed from Google mapping and shown on Figure 2.14, include the following:

- In Fairhaven:
  - Fairhaven High School and associated play fields on Route 6;
  - Older, residential neighborhoods to the north and south of Route 6;
  - A Veterans of Foreign Wars (VFW) Hall; and
  - Seaport Inn and Marina.
- In New Bedford:
  - Pope's Island Park and Marina;
  - Bethel African Methodist Episcopal (AME) Church;
  - Haven Baptist Church;
  - St. Lawrence Church; and
  - Dense single- and multi-family housing between Route 18 and the western Local Study Area boundary.

AIR QUALITY

The EPA established National Ambient Air Quality Standards (NAAQS) pursuant to Section 109 of the Clean Air Act and 1990 Clean Air Act Amendments for the following criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen oxide (NOx), ozone (O_3), particulate matter (PM_{10}), and sulfur dioxide (SO_2).

Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards are set to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings. With the exception of sulfur dioxide, all criteria pollutants have secondary standards that are equal to the primary standards.

When air pollutant levels do not exceed the standard for each pollutant, a region is considered in attainment of the standards. If a monitor shows an exceedance to a pollutant's standard, the region is then classified as nonattainment for that pollutant and must develop a State Implementation Plan to bring the region back to attainment status.

Previously, all of Massachusetts had been designated as nonattainment for ozone. However, on May 21, 2012, EPA designated all of the Commonwealth, except for Dukes County on Martha's Vineyard, as "unclassifiable/attainment" for the latest 8-hour ozone standard (2008). Therefore, a conformity analysis determination for ozone for the 2014-17 Massachusetts State Transportation Improvement Program is not required.

Figure 2.14. Noise Sensitive Locations

2.5.2 Community Resources

The following sections provide a description of the existing community resources found within the Local Study Area. Existing community resources were evaluated using MASSGIS data. The boundaries of the Local Study Area and the location of the existing community resources relative to the New Bedford-Fairhaven Bridge are presented in Figure 2.15.

Several open spaces/parks are located within the Local Study Area. In New Bedford, parks or recreational facilities include Clasky Common Park located west of Route 18, between Purchase and County Streets, as well as a single basketball court near I-195. Closer to the New Bedford-Fairhaven Bridge, Marine Park on Pope's Island is located south of Route 6 and is owned and operated by the City of New Bedford. In addition to the Pope's Island Marina, several smaller marinas are also located on the island. In Fairhaven, the Riverside Cemetery is located just to the south of I-195; there are no parks or open space areas located within close proximity to the bridge within the Town of Fairhaven.

2.5.3 Cultural/Historic/Archeological Resources

METHODOLOGY

For the purposes of this planning level analysis, cultural resources were identified through the National Register of Historic Places Geographic Information System, MASSGIS, and through coordination with the New Bedford Historical Commission. In addition, historical data on the bridge was obtained from the Massachusetts Cultural Resources Information System (MACRIS), including the Historic American Engineering Record documentation for the middle bridge.

Bordered by major rights-of-way, the study area for historic resources was broadly defined based on the potential for the replacement of the bridge to be visible from points on both the east and west sides of the harbor. The properties discussed below include those listed in the National Register of Historic Places as well as at the local level. As the project advances, additional properties that are eligible for the National Register, as well as potential areas of archaeological sensitivity, may be identified through consultation with the Massachusetts Historical Commission (MHC).

HISTORIC PROPERTIES

Constructed on the site of a series of earlier privately owned and operated wooden bridges that first connected New Bedford with Fairhaven in the late 1790s, the current New Bedford-Fairhaven Bridge was completed between 1896 and 1903. Although referred to in its entirety as the New Bedford-Fairhaven Bridge, it is in fact three distinct structures. The middle bridge swing span was completed c.1899.

Figure 2.15. Community Services and Key Destinations

The three bridge structures have undergone significant repairs over the last century. The West Bridge is comprised of ten simple spans. The original portion of the bridge is supported by steel column bents over the land and stone piers over the water. The western end of the west bridge was replaced in 1972 when ramps were constructed connecting the bridge to Route 18. The middle bridge, which crosses the center channel of the harbor, is made up of five plate girder spans and a through truss swing span, all supported on stone piers. Mechanical elements of the East Bridge consist of nine plate girder spans held by stone piers. The roadway stringers and deck portion of the girder spans were replaced on each of the three structures in 1961.

A formal Determination of Eligibility for the middle bridge was undertaken in 1980. In the same year, the MHC found that the West Bridge was not eligible for the National Register, but that the East Bridge did meet National Register eligibility criteria and recommended a formal Determination of Eligibility. When the bridge was initially identified as eligible, MHC stated that they would support demolition of the middle bridge due to the bridge's deteriorated condition, but that the project would be subject to review under Section 106 of the National Historic Preservation Act (NHPA). In addition, they requested that documentation be completed in accordance with Historic American Engineering Record (HAER) standards. This documentation has since been completed.

In a 2002 National Register Eligibility Opinion, the MHC stated, "all three components were built in similar materials and type, at the same time, and by the same engineers and builders." As such, the MHC found that the bridge as a whole is eligible for the National Register. Properties eligible for listing in the National Register, such as the New Bedford-Fairhaven Bridge, are afforded the same protections as those formally listed. Due to federal funding, the replacement of the middle bridge of the New Bedford-Fairhaven Bridge will be subject to the requirements of Section 106 of the NHPA. Under Section 106, federal agencies must take into consideration the effects of their actions on properties listed in, or eligible for listing in, the National Register of Historic Places. As the project advances, the Federal Highway Administration (FHWA), as the lead federal agency, will need to enter into consultation with the MHC to address any effects to historic properties.

A study area for historic resources was defined based on the potential visibility of the middle bridge from the surrounding area. Figure 2.16 shows the boundary of this study area. On the east side, the area encompasses the buildings on the west end of Popes Island east to the Fairhaven waterfront and south to Union Wharf. On the west side of the harbor, the area boundary generally follows MacArthur Drive and Herman Melville Boulevard from the New Bedford-Cuttyhunk Ferry pier in the south to a point just south of Hervey Tichon Avenue in the north. The area also includes those buildings on the west side of Front Street between Union Street and Rodman Street and a small area north of William Street between Water and Bethel streets.

In addition to the bridge itself, a portion of the New Bedford Historic District (the Bedford Landing-Waterfront Historic District) and the Schooner Ernestina, both National Historic Landmarks, lie within the study area, southwest of the New Bedford-Fairhaven Bridge. The Bedford Landing-Waterfront Historic District is also a local historic district within the city of New Bedford. The locations of these areas, along with the historic resources study area are shown in Figure 2.16.

Figure 2.16. Historic Properties and Districts

2.6 MARITIME CONDITIONS

2.6.1 Existing Conditions/Issues

Marine traffic has increased dramatically in the New Bedford Harbor over the past 50 years, including traffic through the New Bedford-Fairhaven Bridge. The characteristics of navigational traffic, including the size and type of vessels, have also changed over time. As discussed previously, this increased traffic has resulted in more frequent and longer bridge openings.

The New Bedford Harbor has a set of restrictions in place regarding the navigation of the channel. Some restrictions are physical and some are based on navigational expertise. The most significant barriers are the hurricane barrier and the New Bedford-Fairhaven Bridge east and west navigational channels. Vessel type and size are the primary consideration in how to plan and manage a transit through the bridge. Other considerations include wind and visibility. Due the hurricane barrier, strong currents are not a significant issue in the harbor. Allisions between vessels and the bridge are infrequent, but have occurred.

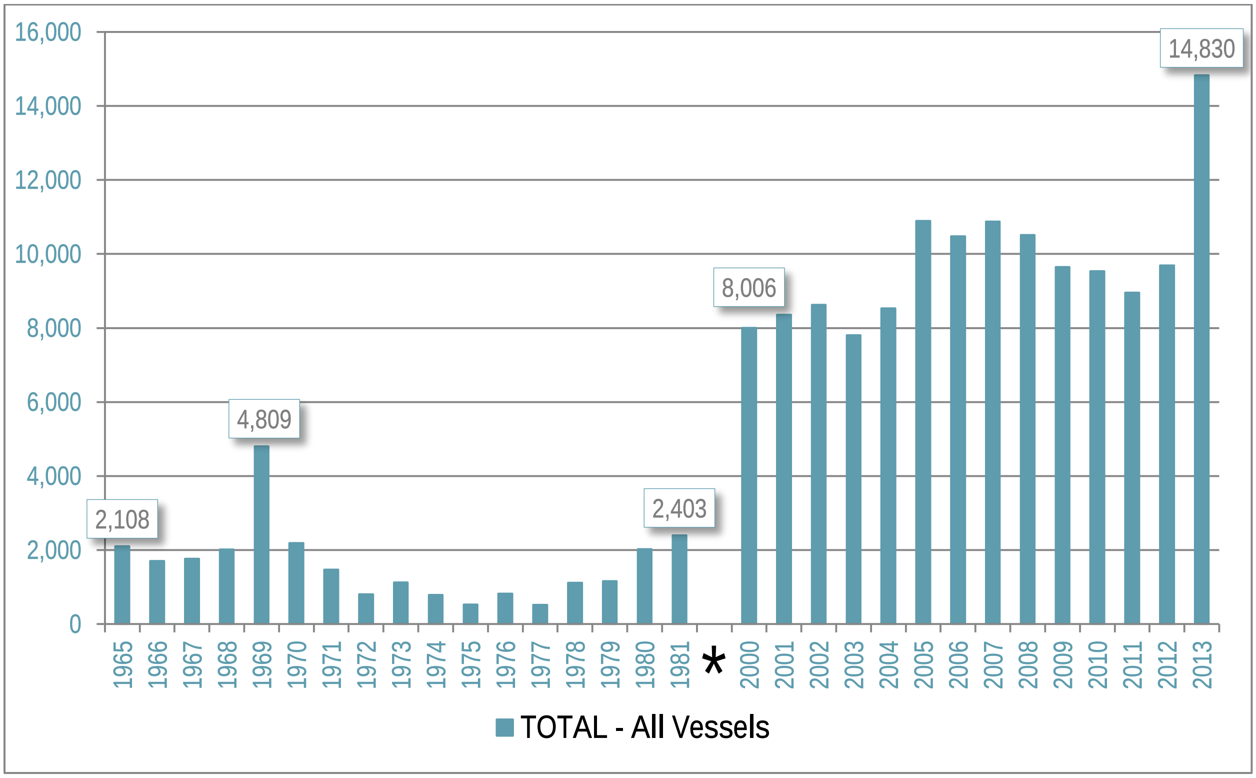
Drawbridge operations are governed by the Federal government, and federal regulations include specific provisions for the New Bedford-Fairhaven Bridge. For vessels with over 15 feet in draft marine traffic has priority over vehicular traffic, but the bridge typically opens per the schedule discussed previously.

CHARACTERISTICS OF EXISTING NAVIGATIONAL TRAFFIC

The New Bedford-Fairhaven Bridge tender records the number and type of all vessels that pass through the bridge. As shown in Figure 2.17, the volume of navigational traffic through the bridge has substantially increased over the past 50 years. In 1965, approximately 2,100 vessels passed through the bridge. The number has grown steadily over the years, but peaked in 2013 when over 14,800 vessels passed through the bridge. Between 2012 and 2013, the number of vessels increased by over 5,000 vessels per year, or almost 250 percent in just a single year. It is anticipated that this increased level of vessel traffic will continue in the coming years.

Each vessel that passes through or “transits” the bridge is assigned to one of five different categories: steamers-motor ships (cargo ships/tankers or large fishing vessels), fishing vessels (commercial), pleasure craft (recreational boats, sailboats), tow boats (tugs), and towed crafts (barges). Table 2.9 provides the physical characteristics of each type of vessel, including the typical beam (width) and height. The table also lists the number of vessels by type in 2013.

Figure 2.17. Annual Navigational Traffic, 1965 to 2013



**Note: Data not available for 1982 to 1999*
Source: 1985 Environmental Assessment, 2000-2013 MassDOT Monthly Drawbridge Reports

Table 2.9. Vessel Characteristics, 2013

Vessel Type	Typical Beam (feet)	Typical Height (feet)	Annual Navigational Traffic (2013)
Cargo Ships (tankers) / Large Fishing Vessels	70-90	90-110	452
Fishing Vessels (commercial)	20-35	40-60	4,991
Pleasure Crafts (sail boats, recreational)	6-18	8-80	3,002
Tow Boats (tugs)	12	12	3,425
Towed Crafts (barges)	30-40	40-60	2,960

Source: 2013 MassDOT Monthly Drawbridge Report

Over the past 30 years as the total navigational volume has increased, the number of vessels by type has also changed. While the number of commercial fishing vessels more than tripled between 1981 and 2013, as a percent of total vessels, fishing vessels declined as more tow boats and barges passed through the bridge. The number of cargo ships/large fishing vessels and recreational vessels has also increased, but as a percent of the total vessels, they have remained the same. Table 2.10 summarizes the change in vessel type between 1981 and 2013.

Table 2.10. Marine Traffic by Vessel Type, 1981 to 2013

Vessel Type	1981 Vessels	1981 % of Total	2000 Vessels	2000 % of Total	2013 Vessels	2013 % of Total
Cargo Ships (tankers) / Large Fishing Vessels	81	3%	174	2%	452	3%
Fishing Vessels (commercial)	1,249	52%	3,838	48%	4,991	34%
Pleasure Crafts (sail boats, recreational)	522	22%	1,441	18%	3,002	20%
Tow Boats (tugs)	276	11%	1,448	18%	3,425	23%
Towed Crafts (barges)	275	11%	1,105	14%	2,960	20%
TOTAL – ALL VESSELS	2,403		8,006		14,830	

Source: 1985 Environmental Assessment, 2000 and 2013 MassDOT Monthly Drawbridge Reports

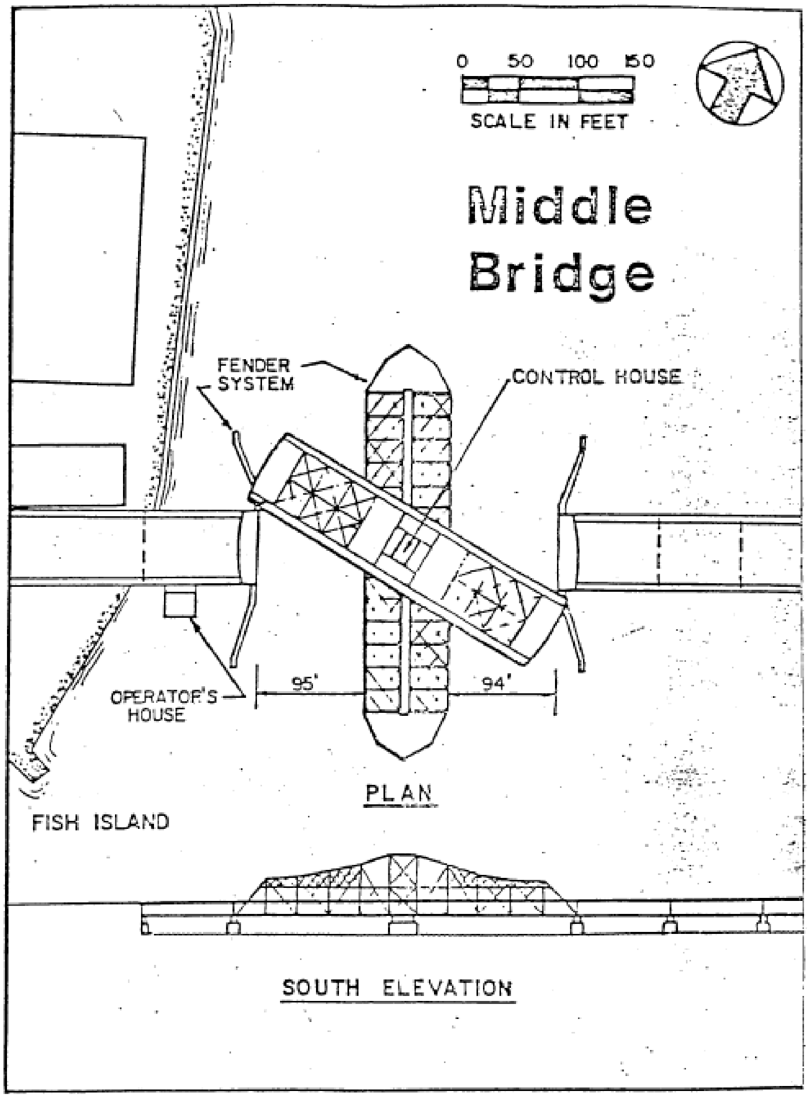
HARBOR NAVIGATIONAL CONSTRAINTS

The harbor presents several constraints or considerations to navigational traffic, including vessel size, vessel speed, wind and visibility issues, and required pilotage and tug fees. To navigate these various port constraints, a pilot is employed by the larger vessel to serve as an advisor to the vessel's master. To optimize vessel safety and transit, the International Maritime Organization provides direction to pilots, including a set of criteria that the pilot and vessel master should agree upon prior to navigation through the harbor. In November of 2009, the pilots revised and distributed their harbor transit parameters for New Bedford Harbor. This section details those parameters and limitations to marine traffic in the harbor.

All ports assess pilotage fees based on vessel size and distance of transit. For commercial vessels of 350 gross tons or over, pilotage in New Bedford Harbor, including passage through the bridge, is compulsory. This excludes most commercial fishing boats and recreation vessels. Pilotage applies to all foreign vessels and to U.S. vessels under registry. Northeast Marine Pilots, Inc. of Newport, RI, provides experienced pilots for transiting the harbor. In New Bedford, pilots charge for cargo ships transiting the harbor on a round trip basis. A surcharge is assessed for vessels that transit the bridge. The cost for larger boats to pass through the bridge is higher than vessels that do not need to get north of the bridge.

The hurricane barrier and New Bedford-Fairhaven Bridge present the largest physical constraint to marine traffic, due to the width limitations. The federal shipping channel narrows from 350 feet to 150 feet at the harbor's hurricane barrier. The east and west navigational channels at the New Bedford-Fairhaven Bridge further limit the vessels that can pass, with a navigational width of only 92 feet on either side of the bridge's central pier (see Figure 2.18).

Figure 2.18. New Bedford-Fairhaven Bridge Width and Clearance



Source: 1985 Environmental Assessment

The vertical clearance of the New Bedford-Fairhaven Bridge also presents a constraint to vessels that can pass without the bridge opening. The vertical clearance under the bridge is six feet. Most vessels are not able to pass underneath the bridge without opening the bridge. This includes small recreational boats. Comparatively, the I-195 highway bridge located north of the New Bedford-Fairhaven Bridge has a six-foot vertical clearance and the Coggeshall Street Bridge has a six-foot clearance. Both of these bridges are fixed and effectively create a northern barrier for vessels in the New Bedford Harbor.

The shipping channel and bridge also present limitations to vessel depth and speed. While the federal shipping channel is 30 feet deep, under keel clearance requirements results in an effective transit draft of 26 feet for vessels. New Bedford Harbor requires a slow speed transit. The speed limit in the harbor is 5 mph.

Wind speed is the primary concern that limits vessels ability to pass through the bridge. In all cases, if the wind exceeds 25 knots, no vessel under pilotage will transit the bridge due to the difficulty of safe transit in high winds. If the vessel is over 400 feet in length, this may be reduced to as little as 12 knots given the direction and based on the pilot's discretion. Current is not an issue at the bridge, but as noted, visibility and the amount of daylight is. Ships tend to use the 95-foot-wide west channel rather than the east channel that is 94 feet in width. There is also a concern with the amount of moored vessels above the bridge because it reduces maneuvering room. Boats moored at the east side marina are not always moored tightly to piers. This loose mooring further reduces the horizontal clearance through the channel where every foot of clearance is needed for many vessels to safety navigate.

According to procedures established by the tug boat pilots, which are based on their extensive experience with transiting the hurricane barrier opening, no vessel will transit through the hurricane barrier, harbor, or bridge if the visibility is less than one nautical mile. Vessels greater than 500 feet in length or over 80 feet in beam transit through the hurricane barrier in daylight only. Ships with poor visibility or large freeboard may also require daylight transit as a clear view of the two red lights on each side is critical for a night transit of the barrier. Proper operation of the aforementioned red lights is also a requirement for night transit.

Tidal currents within the harbor, including the areas around the New Bedford-Fairhaven Bridge, are generally considered weak. At the hurricane barrier, the maximum-recorded flood and ebb velocity average approximately 2.4 knots. Slack water occurs 30 minutes before the time of low or high water, with maximum current occurring at the same time when the greatest change of tidal height takes place. Tidal current is generally less of a consideration for transiting than wind and visibility.

Climate data for New Bedford shows that during summer months, the prevailing winds are from the south to the southwest. In the winter, the prevailing winds are from the north to the west. Limitations in visibility can occur rapidly in the harbor due to fog or heavy precipitation. The channels, anchorage and bridge passages are generally ice-free during the winter months except when periods of extreme cold are observed.

Large commercial vessels will generally employ harbor tugs for ship assist when maneuvering through the harbor and the bridge. While the maximum available tug for ship assist is listed at 2200 brake horsepower (BHP), available ship assist tugs have HP ratings between 800 and 1000 BHP.

When transiting the bridge, there is limited room to maneuver. Vessels approach slowly and then increase speed as they enter the bridge opening to insure they can exercise better control of the vessel in the passage. When northbound, there is not a lot of room north of the bridge, on the basin side, for stopping or maneuvering. Generally, two tugs are employed; one at the bow and one at the stern, but only one can assist once the vessel is in the bridge opening. The forward tug goes through the bridge first and can come back alongside once the bow clears.

Proceeding northbound, once the vessel passes through the bridge and enters the basin, it must slow and stop. On most diesel-propelled vessels without variable pitch propellers, the vessel must stop and reverse its engine. If there is an engine failure, the stern tug, which has a line up on the vessel, can be used to stop the forward motion of the ship. Once the vessel reaches a point where it can be lined up with the approach to the terminal, it is backed into the Maritime Terminals berth. The harbor pilots, or tug operators, noted that vessel engine failures can create difficult situations regarding vessel control and stopping distance since vessels transiting the bridge may be moving along at 6 knots through the opening.

Generally, vessels do not require tugs on transiting outbound. When departing outbound, the vessel leaves the berth and turns in the basin in a manner that allows it to line up with the west channel, which is used most of the time. Once lined up, it transits the opening and maintains its alignment with the Federal deep-water channel. The bridge central pivot point, associated piers and fendering system are located approximately in the center of the channel reducing the available passage space to less than half that of the authorized channel width. This makes the bridge, in the perspective of the pilots, the most vulnerable navigation safety area in the harbor. The opening is too narrow and the safety concern increases because there is not enough room for a tug to stay alongside the vessel to assist in transit and to control the vessel's movement as is common in most other harbors. During interviews for this study, harbor pilots noted that a 500-foot-long vessel with a 75-foot-wide beam is probably the biggest vessel that has transited the bridge in the past few decades.

The harbor pilots interviewed also expressed concern that vessels approaching the bridge opening do so on an angle. This is due to ships operating at slow maneuvering speeds. To the pilot and master, this makes it appear like there is less width than is actually present. Visibility from the bridge or bridge wings varies with each vessel, as well as how the bridge affects sight lines when maneuvering.

According to Maritime Terminals, two tugs are typically used which cost approximately $300 to $400 per hour based on horsepower. Average total cost for two tugs including maneuvering through the bridge and docking and undocking is around $7,200. Recently, a third tug was required for a specific vessel, which increased the cost for the three tugs to nearly $18,000.

Harbor pilots acknowledged that their restrictions are considered tight but are in place primarily for safety reasons, which are considered paramount. Restrictions can delay arrivals and departures at Maritime Terminals' berths. In some cases, ships have to divert to the State Pier, which is located south of the bridge. Cargo is then trucked to the refrigeration area at Maritime Terminals, which results in added costs for the shippers.

Allisions are infrequent but they do occur. No significant allisions have occurred in recent years. The majority of vessels that transit through the bridge are fishing vessels that do not require pilotage. Allisions with the bridge are more significant when a vessel under pilotage touches the bridge structure because of their size. Pilots take the ships and barges through the bridge and are required to report any allisions with bridge or fender structures.

At the north side of the bridge, the channel abuts the piers on the east side. The west navigational channel at the bridge provides more maneuvering room and is more frequently used. As previously discussed, the bridge opening width is a constraint and maneuvering is made more difficult by the vessels moored on Fish Island near the opening on the north side of the bridge. There have been no reported issues regarding vessels running aground in the basin beyond the bridge or collisions in the basin area.

U.S. Coast Guard representatives noted that a bridge with a single, wider channel would be preferable to the current bridge with two channel openings. Additionally, a bridge that offers additional vertical and horizontal clearance and a reinforced fendering system to protect the bridge structure would add an additional safety factor for ships and the bridge. The alignment with the shipping channel is not a problem with the current bridge. Additional channel depth north of the bridge could help the vessel maneuverability.

FEDERAL SAFETY ISSUES

Draw bridge openings are regulated by the Federal government with regulations contained in Title 33 (Navigation and Navigable Waters), Part 117 (Drawbridge Operation Regulations), Sections 117.1 to 117.59 (General Regulations and Specific Regulations) and 117.585 (New Bedford Harbor). The Sector Commander for Southeast New England has the authority to impose additional navigation requirements or restrictions depending on safety factors related to the prevention of marine accidents. Currently, there are no Coast Guard regulatory constraints related to the bridge. The Coast Guard acknowledges the restrictions that the New Bedford harbor pilots have put in place, including additional restrictions related to bridge transits. Section 117.585 lists the specific following regulations for the Acushnet River/New Bedford Harbor:

> The New Bedford-Fairhaven Bridge, mile 0.0, will open promptly, provided proper signal is given, on the following schedule:
>
> (a) The draw will be opened at any time for vessels whose draft exceeds 15 feet, for vessels owned or operated by the U.S. Government, the State of Massachusetts, or by local authorities.
>
> (b) Each opening of the draw, from the time vehicular traffic flow is stopped until the flow resumes, shall not exceed 15 minutes except for vessels whose draft exceeds 15 feet or in extraordinary circumstances.
>
> (c) From 6 p.m. on December 24 to midnight on December 25 and from 6 p.m. on December 31 to midnight on January 1, the draw shall open on signal if at least a two-hour notice is given by calling the number posted at the bridge.

PORT OF NEW BEDFORD MARINE FACILITIES

The Port of New Bedford includes several terminals on the New Bedford side of the harbor. The State Pier, Sprague Terminal, and the Marine Commerce Terminal (formerly South Terminal) located south of the bridge. The Maritime Terminal, Bridge Terminal, and the North Terminal are located north of the bridge.

Key components of the northern part of the harbor, known as the North Pier Area, are the direct highway connections to I-195 and Route 6 and the New Bedford Rail Yard. Connecting to the north and into the national railroad network, the 33.5-acre rail facility has 12 acres available for rail car staging and can accommodate 100 rail cars in its present configuration. These critical intermodal connections, along with a large amount of industrial land and potential for expanded berthing, provide the port with a viable and realistic seaport development zone. This includes further development of deep water berthing constrained only potentially by the existing bridge. Currently, the New Bedford-Fairhaven Bridge limits the size of vessels that can enter the north harbor area and limits the expansion potential of existing maritime uses within the Designated Port Area north of the bridge.

The majority berthing of the vessels north of the New Bedford-Fairhaven Bridge is generally occupied by commercial fishing vessels. There are, however, several deep-water commercial wharves and facilities for handling of cargo above the bridge. The following wharves and facilities handle vessels that transit the bridge:

- **Maritime Terminal.** The Maritime Terminal wharf is 600 feet long with 31 feet of berth depth and a 30-foot-wide cargo-handling apron. Direct ship to warehouse transfer is most efficient for their cargo handling activities. Ship's gear, if available, or a crane is used for ship to wharf transfer. The landing weights on the pier are sufficient to handle a crane and cargo. The facility on the New Bedford mainland has 3 million cubic feet of refrigerated storage. The facility handles frozen fish, food products and chilled agricultural products as well as break-bulk (general) cargo. The facility is owned by Maritime Terminal, Inc.
- **Bridge Terminal**. This wharf is 450 feet long with 28 feet of berth depth. The facility has 500,000 cubic feet of reefer (refrigerated) storage space. The facility handles frozen and chilled agricultural food products. Located on the northeast side of Fish Island, the facility is owned by Maritime Terminal, Inc.
- **Frionor Wharf (name possibly in transition)**. This wharf is 580 feet long, and averages 25 to 28 feet of berth depth. Operated as a processing and distribution center, the facility has 120,900 square feet of reefer and freeze space and 34,700 square feet of warehouse space. The facility handles frozen fish and is owned by Highliner, Inc.
- **North Terminal.** This 10-acre facility is located 400 yards northwest of Fish Island, and was built as the USEPA dredge spoils transfer site. The facility has 300 feet of bulkhead with an alongside draft of 15 feet. The facility has on dock rail with a roll-on/roll-off ramp (Ro-Ro) for barge transfer. The current long-term plan includes an expansion of the bulkhead to 1,200 feet and berth dredging. The facility is managed by the HDC.
- **Packer Marine Facility.** This two-acre facility is located adjacent to the New Bedford Rail Yard. The facility has a Roll-on/Roll-off (Ro-Ro) ramp and 200 feet of berthing space with 23 feet alongside. The facility is owned by R.M. Packer Co.
- **Marlees Seafood Facility.** This 2.9-acre facility with open storage and loading/unloading area. It also has a rail spur and 263 feet of bulkhead with an alongside draft of 20 feet. The facility is owned by Marlees Seafood, Inc. of New Bedford.
- **Revere Copper Facility.** This 12.5-acre facility has 3.6 acres of open storage and an 8.9-acre building. The facility is located at the north end of the basin and has a 520-foot bulkhead with 20 feet of water alongside. The site is owned by Revere Copper Products, Inc.

- **Kilburn Street Site.** This parcel consists of 4.8 acres of open storage and is currently northernmost of the facilities. The site has the potential capability to have a 550 foot bulkhead installed with an alongside draft of 30 feet. It is owned by Revere Copper Products, Inc.

Located south of the New Bedford-Fairhaven Bridge, the other main commercial facility available in New Bedford is the State Pier. This facility is frequently used to off-load cargo, but it is weight limited and has no crane. The new Marine Commerce Terminal at the southern end of the harbor is currently under construction, but its business model is designed for heavy lift and project cargo, not for fruit or agricultural products. Use of these facilities require a truck dray from their location to the Maritime Terminals facility located north of the bridge, which creates an additional expense to the handling cost.

2.6.2 Planned Improvements

The City of New Bedford currently has no plans to change the zoning from industrial activities north of the bridge or alter the uses within the DPA. Currently Marine industrial activities are the primary business along the west side of the north harbor. HDC officials noted that discussions about use of these properties for other purposes occurs occasionally, but that future non-industrial uses are unlikely. The HDC indicated that State Pier is the only area with potential for some mixed maritime and tourism activities. The new Marine Commerce Terminal area and the area north of the bridge are more appropriate for industrial activities. The HDC has expressed interest in developing some of the north properties of the basin into another offshore wind farm support area, north of the current EPA facility.

The new Marine Commerce Terminal is the primary facility for port expansion at this point. The project will be complete in mid-2015. Dredging is already underway and there is some discussion about potentially widening the planned access channel because of difficulties regarding the movement of ships down the new channel and docking of vessels. The landside area will be the last portion developed. The Marine Commerce Terminal is a $113 million project, comprised of approximately 21 acres designed for heavy weight cargo handling such as project components.

2.7 VEHICULAR TRANSPORTATION

2.7.1 Data Collection & Methodology

TRAFFIC COUNTS

To review traffic patterns within the Regional Study Area, traffic volume data was collected in the form of Video Turning Movement Counts (VTMCs), Automatic Traffic Recorders (ATR) Counts, and pedestrian counts. MassDOT closed the New Bedford-Fairhaven Bridge to vehicular traffic for necessary structural repairs in April 2014. The traffic counts were conducted twice at the same locations during April 2014; once during a period when the New Bedford-Fairhaven Bridge was closed (April 8, 2014) and once when the bridge was open (April 17, 2014).

When the bridge was closed, VTMCs and ATR counts were performed in the Regional Study Area. These counts were reviewed to note the change in traffic flow patterns and potential detour routes that drivers may travel during the bridge closure. The following detour plan was posted for drivers by MassDOT:

- Route 6 westbound traffic - travel north along Main Street, left onto Howland Road until Coggeshall Street, and left onto Route 18 southbound.
- Route 6 eastbound traffic - travel along Route 18 northbound onto I-195 eastbound at Exit 15 to Exit 18 and onto Route 240 southbound.

The VTMC locations are listed in Table 2.11. The VTMCs included the following vehicle classifications: cars, trucks, buses, pedestrians, and bicycles. Each were counted in 15-minute intervals for the following peak periods:

- Weekday AM Peak Period: 6:30 AM – 9:30 AM
- Weekday PM Peak Period: 3:30 PM – 6:30 PM

Table 2.11. VTMC Locations during Bridge Closure

No.	Traffic Control	Intersection
1	Signal	Coggeshall Street and Belleville Avenue
2	Signal	Hillman Street and Purchase Street
3	Signal	Kempton Street and Purchase Street
4	Signal	Bridge Street and Alden Road
5	Signal	Bridge Street and Route 240

Table 2.12 shows the locations where ATR counts were collected during the bridge closure.

Table 2.12. ATR Locations during Bridge Closure

No.	Location Name
1	Route 18 SB off-ramp
2	Route 18 NB off-ramp
3	EB ramp from I-195 to SB Route 240
4	NB ramp from Route 240 to EB I-195
5	NB Route 240 to WB I195
6	Mt Pleasant Street at EB I-195
7	County Street at Parker Street
8	Route 140 North of Route 6
9	Coggeshall Street Bridge
10	Adams Street (Linden Avenue to Elm Street)
11	Main Street (North Street to Oxford Street)

To analyze traffic patterns when the bridge is open to vehicular traffic, MassDOT provided historical and recent traffic counts (hourly and daily) on select roadways in the Regional Study Area. VTMCs were conducted at 36 locations within the Regional Study Area on April 17, 2014 (Thursday). Although the bridge was open to vehicular traffic during this period, the number of lanes across the bridge was restricted due to the on-going construction activities. It is assumed that this restriction has resulted in decreased vehicle volumes through out the local study area and that the vehicle counts do not represent the full demand for vehicular travel. It is assumed that upon completion of construction activities, vehicle volumes will increase.

The VTMCs were collected for cars, trucks, buses, pedestrians, and bicycles for the following peak periods:

- Weekday AM Peak Period: 6:30 AM – 9:30 AM
- Weekday PM Peak Period: 3:30 PM – 6:30 PM

VTMCs were collected in 15-minute intervals and were used to develop peak-hour traffic volume. The 36 locations where the VTMCs were collected are listed in Table 2.13.

Table 2.13. VTMC Locations, No Bridge Closure for Construction

No.	Traffic Control	Intersection
1	Signal	Route 6 (Kempton Street) and Route 140 (Brownell Ave)
2	Signal	Kempton Street and Cornell Street
3	Signal	Kempton Street and Rockdale Avenue
4	Signal	Mill Street and Rockdale Avenue
5	Signal	Mill Street and Cottage Street
6	Signal	Kempton Street and Cottage Street
7	Signal	Mill Street and County Street
8	Signal	Kempton Street and County Street
9	Signal	Kempton Street/Mill St and Purchase Street/Pleasant Street
10	Signal	Route 6 (Huttleston Ave) and Middle Street
11	Signal	Route 6 (Huttleston Ave) and Main Street
12	Signal	Route 6 (Huttleston Ave) and Green Street
13	Signal	Route 6 (Huttleston Ave) and Adams Street
14	Signal	Route 6 (Huttleston Ave) and Holcomb Street
15	Signal	Route 6 (Huttleston Ave) and Bridge Street
16	Signal	Route 6 (Huttleston Ave) and Alden Road
17	Signal	Route 6 (Huttleston Ave) and Route 240 (Sconticut Neck
18	Signal	Bridge Street and Alden Road
19	Signal	Bridge Street and Route 240
20*	Signal	Union Street and Route 18 (JFK Memorial Hwy)
21	Signal	Hillman Street and Purchase Street
22	Stop	Hillman Street and Northbound JFK Memorial Hwy on-ramp
23	Stop	Purchase Street and southbound JFK Memorial Hwy off-
24	Stop	Linden Street and County Street
25	Stop	Washburn Street and Belleville Avenue
26	Stop	Coggeshall Street and Mount Pleasant Street
27	Signal	Coggeshall Street and County Street
28	Signal	Coggeshall Street and Purchase Street
29	Signal	Coggeshall Street and Ashley Boulevard
30	Signal	Coggeshall Street and Acushnet Avenue
31	Stop	Coggeshall Street and N Front Street
32	Signal	Coggeshall Street and Belleville Avenue
33	Signal	Coggeshall Street and WB I-195 off-ramp
34	Signal	Howland Road and Main Street
35	Signal	Howland Road and Adams Street
36	Stop	Howland Road and Alden Road

**Almost no vehicular volumes were counted on Union Street potentially due to street closure.*

Automated Traffic Recorder (ATR) counts were provided by MassDOT for 24 locations. A list of the locations is shown in Table 2.14. The counts for locations numbered 4 to 10, 12 to 15, and 20 were collected in 15-minute increments for a seven-day period in April 2014. ATR counts for locations numbered 1-3, 11, 16 to 19, and 21-24 were collected from previous MassDOT projects.

Table 2.14. ATR Locations, No Bridge Closure for Construction

No.	Year	Location Name
1	2012	Route 6 west of RT 140/Brownell Ave
2	2013	Route 6 west of Watson Street – Eastbound and Westbound
3	2011	Rockdale Avenue between Kempton Street and Mill Street – Northbound and Southbound
4	2014	Mill Street and Hill Street
5	2014	Kempton Street and County Street
6	2014	Route 6 east of Pleasant Street – Eastbound and Westbound
7	2014	Southbound JFK Memorial Highway ramp to Eastbound Route 6
8	2014	Route 6 on Bridge at Fish Island – Eastbound and Westbound
9	2014	Route 6 (Huttleston Ave) on east end of Bridge – Eastbound and Westbound
10	2014	Huttleston Ave and Holcomb Street – Eastbound and Westbound
11	2011	Route 240 south of I-195 – northbound and southbound
12	2014	Eastbound ramp from I-195 to southbound Route 240
13	2014	Northbound ramp from Rt. 240 to Eastbound I-195
14	2014	Westbound off-ramp to southbound Rt. 240
15	2014	Northbound Route 240 to WB I-195
16	2012	Coggeshall Street Bridge
17	2012	Coggeshall Street and Ashley Boulevard – Eastbound and Westbound
18	2012	I-195 east of Route 140
19	2012	Northbound Route 140 ramp to Eastbound I-195
20	2014	Eastbound I-195 ramp to southbound Rt. 140
21	2012	Route 140 North of Route 6 – Northbound and Southbound
22	2012	Mt Pleasant Street at I-195 – Northbound and Southbound
23	2012	County Street and Parker Street – Northbound and Southbound
24	2012	Union Street west of County Street –Eastbound and Westbound

**2014 counts were conducted during Bridge Open.*

FIELD OBSERVATIONS

As part of the data collection effort, field visits were conducted to obtain current intersection geometries, traffic control, signal timing and phasing information and traffic operating conditions. The intersection geometries included information such as lane configurations, lane widths, turning bays, crosswalk and sidewalks, bus stop locations, channelized right-turns and bike or bus lanes. The traffic control information collected includes location of stop/yield signs, signal heads, pedestrian push buttons and turn restrictions. The signal timing and phasing information and the type of signal operation was also noted for all signalized intersections. The operating conditions at each intersection are noted in the form of average queue lengths on each approach. The queue lengths were measured for about two to three cycle lengths to determine typical existing peak hour operating conditions. Any unusual conditions such as illegal traffic maneuvers and vehicles experiencing significant delays were noted. A summary of field observations is included as part of Section 2.7.2.

SIGNAL TIMING PLANS

Twenty-nine out of the 36 intersections are signal controlled while the remaining intersections are stop controlled. The signal timing splits, phasing, offsets, actuation, and coordination information for each intersection provided by MassDOT were used where available and were supplemented by observed signal timing collected in the field. The signal timing plans provided by MassDOT were compared against the observed signal timing collected in the field. The signal timing that most accurately reflects the existing operating conditions were used in the capacity analysis.

Table 2.15 indicates the intersections for which signal-timing plans provided by MassDOT were used in the capacity analysis. Table 2.15 also indicates the intersections for which observed signal timing collected in the field were used in the capacity analysis.

Table 2.15. Intersections with Signal Timing Plans Provided by MassDOT

Intersections with Timing Plans
Route 6 (Kempton Street) and Route 140 (Brownell Ave)
Kempton Street and Cornell Street
Kempton Street and Rockdale Avenue
Mill Street and Rockdale Avenue
Mill Street and Cottage Street
Kempton Street and Cottage Street
Mill Street and County Street
Kempton Street and County Street
Route 6 (Huttleston Ave) and Middle Street
Route 6 (Huttleston Ave) and Main Street
Route 6 (Huttleston Ave) and Green Street
Route 6 (Huttleston Ave) and Adams Street

Intersections with Timing Plans
Route 6 (Huttleston Ave) and Holcomb Street
Route 6 (Huttleston Ave) and Alden Road
Route 6 (Huttleston Ave) and Route 240 (Sconticut Neck Road)
Bridge Street and Alden Road
Bridge Street and Route 240
Union Street and Route 18 (JFK Memorial Highway)
Coggeshall Street and WB I-195 off-ramp
Howland Road and Main Street
Howland Road and Adams Street
Kempton Street/Mill Street and Purchase Street/Pleasant Street
Route 6 (Huttleston Ave) and Bridge Street
Hillman Street and Purchase Street
Coggeshall Street and County Street
Coggeshall Street and Purchase Street
Coggeshall Street and Ashley Boulevard
Coggeshall Street and Acushnet Avenue
Coggeshall Street and Belleville Avenue

TRAVEL TIME SURVEYS

Travel times and delay runs were conducted on April 17, 2014 and May 7, 2014 during AM and PM peak periods. The data collection hours were 6:30 AM to 9:30 AM and 3:30 PM to 6:30 PM. The data was collected using the floating car method.[1] Holux M-241 Global Positioning System (GPS) devices were placed in each car to collect detailed time and distance measurements.

The travel time and delay runs were recorded along the following roadways:

- Route 6 corridor between Route 140 and Route 240;
- Coggeshall Street corridor between Purchase Street and Main Street;
- I-195 section between Route 140 and Route 240;
- Route 140 corridor between I-195 and Route 6;
- Route 240 corridor between I-195 and Route 6;
- Purchase Street corridor between Coggeshall Street and Route 6; and
- Main Street corridor between Coggeshall Street and Route 6.

[11] The floating car method involves driving a specific corridor between pre-determined points at the prevailing speed of traffic on the roadway (essentially passing as many cars as pass the data collection vehicle). The vehicle location is then recorded over time to allow for the calculation of a mean speed.

Detailed time and distances were analyzed using iTREC, a stand-alone software package developed by HDR. It uses GPS logger data to calculate speed along a corridor, delay experienced by the vehicle, and the number of stops during travel.

Table 2.16 shows average speed and travel time along the following segments (see Figure 2.19):

1. Coggeshall Street between Purchase Street and Main Street;
2. Route 6 corridor between Route 140 and Purchase Street;
3. Route 6 between Purchase Street and Main Street (New Bedford-Fairhaven Bridge);
4. Route 6 corridor between Main Street and Route 240;
5. I-195 between Route 140 and Route 240;
6. Main Street between Huttleston Avenue and Howland Road;
7. Purchase Street between Route 6 (Kempton Street) and Coggeshall Street;
8. Route 240 corridor between I-195 and Route 6; and
9. Route 140 corridor between I-195 and Route 6.

Figure 2.19. Travel Time Run Routes

Table 2.16. Average Speed and Travel Time Summary

Segment	Direction	Peak Period	Average Speeds (mph)	Average Travel Time
1. Coggeshall Street between Purchase Street and Main Street	Eastbound	AM	23.65	3min 46sec
	Eastbound	PM	21.57	3min 52sec
	Westbound	AM	29.19	3min 12sec
	Westbound	PM	17.03	4min 05sec
2. Route 6 between Route 140 and Purchase Street	Eastbound	AM	25.09	3min 43sec
	Eastbound	PM	24.2	3min 38sec
	Westbound	AM	26.17	3min 17sec
	Westbound	PM	25.17	3min 23sec
3a. Route 6 between Purchase Street and Main Street (New Bedford-Fairhaven Bridge open)	Eastbound	AM	30.52	2min 28sec
	Eastbound	PM	32.7	2min 13sec
	Westbound	AM	28.01	2min 39sec
	Westbound	PM	28.11	2min 36sec
3b. Route 6 between Purchase Street and Main Street (New Bedford-Fairhaven Bridge closed)	Eastbound	AM	8.08	8min 37sec
	Eastbound	PM	5.7	12min 17sec
	Westbound	AM	8.26	8min 31sec
	Westbound	PM	5.03	14min 07sec
4. Route 6 between Main Street and Route 240	Eastbound	AM	15.31	6min 09sec
	Southbound	PM	16.01	5min 52sec
	Westbound	AM	12.64	7min 26sec
	Westbound	PM	13.02	7min 12sec
5. I -195 between Route 140 and Route 240	Eastbound	AM	60.26	2min 44sec
	Southbound	PM	63.38	2min 37sec
	Westbound	AM	61.82	3min 02sec
	Westbound	PM	55.92	3min 21sec
6. Main St between Huttleston Avenue and Howland Road	Northbound	AM	32.85	1min 51sec
	Northbound	PM	29.7	2min 00sec
	Southbound	AM	33.95	1min 47sec
	Southbound	PM	32.33	1min 56sec
7. Purchase Street between Kempton Street and Coggeshall Street	Northbound	AM	21.8	4min 09sec
	Northbound	PM	22.3	4min 04sec
	Southbound	AM	28.78	2min 42sec
	Southbound	PM	25.48	3min 22sec
8. Route 240 between I-195 and Route 6	Northbound	AM	34.79	3min 22sec

Segment	Direction	Peak Period	Average Speeds (mph)	Average Travel Time
	Northbound	PM	45.49	2min 34sec
	Southbound	AM	42.54	2min 13sec
	Southbound	PM	36.25	2min 37sec
9. Route 140 between I-195 and Route 6	Northbound	AM	49.59	1min 39sec
	Northbound	PM	51.18	1min 36sec
	Southbound	AM	43.61	2min 37sec
	Southbound	PM	22.81	5min 31sec

CRASH DATA COLLECTION

The most recent three-year available crash database (2009-2011) for New Bedford and Fairhaven was obtained from MassDOT. This database includes information such as crash location, number of vehicles, number of injuries or fatalities, type of collision, vehicle direction, and weather and road surface conditions.

The crash data was plotted in GIS to spatially represent the crashes within the Regional Study Area. All the crashes within 75 feet radius from each count intersection were included and plotted by year on the maps provided in Appendix B. The crash data was analyzed to identify high crash locations along Route 6 and potential detour routes. A detailed discussion of the crashes involving fatalities, bicycles, and pedestrians is provided in Section 2.7.4.

PEAK HOUR DETERMINATION

The peak hours used in the capacity analysis were calculated based on the VTMC data collected during the three-hour AM and PM peak hour periods. The VTMC data, which is organized in 15-minute intervals, was analyzed by calculating the peak hour for each intersection and then for all intersections combined. The peak hours for the weekday AM and PM peak hour analyses were determined to be as follows:

- Weekday AM Peak hour: 7:30 AM – 8:30 AM
- Weekday PM Peak hour: 4:00 PM – 5:00 PM

CAPACITY ANALYSIS

A capacity analysis was conducted for the study locations to identify existing and future traffic conditions within the Local Study Area. Capacity analysis is a method by which traffic volumes are compared to the calculated roadway and intersection capacities to evaluate estimated future traffic conditions. The Transportation Research Board describes the methodology used in the 2000 Highway Capacity Manual (HCM). In general, the terminology "Level of Service" (LOS) is used to provide a "qualitative" evaluation based on certain "quantitative" calculations related to empirical values.

As described in the 2000 HCM, LOS ranges from A to F. In general, LOS A represents the best traffic operating condition and LOS F represents the worst condition (typically associated with congestion and long delays). The LOS values for unsignalized and signalized intersections are defined in terms of average delay (seconds delay/vehicle). Delay is used as a measure of driver discomfort, frustration, and efficiency. See Table 2.17 for the LOS criteria for signalized and unsignalized intersections.

Table 2.17. 2000 HCM LOS Criteria for Signalized and Unsignalized Intersections

LOS	Average Control Delay (seconds/vehicle) Signalized	Average Control Delay (seconds/vehicle) Unsignalized
A	Less than or equal to 10.0	Less than or equal to 10.0
B	10.0 to 20.0	10.0 to 15.0
C	20.0 to 35.0	15.0 to 25.0
D	35.0 to 55.0	25.0 to 35.0
E	55.0 to 80.0	35.0 to 50.0
F	Greater than 80.0	Greater than 50.0

Source: HCM 2000

TRAFFIC ANALYSIS TOOL

The balanced existing traffic volume data and other supporting data (geometrics, official signal timing, and detailed field inventory information) were used to develop preliminary existing peak hour Synchro analysis. A capacity analysis was conducted for 36 intersections in the Regional Study Area to determine the existing traffic operating conditions. This study used the Synchro (Version 8) intersection analysis software to calculate vehicular delay at the study intersections. Synchro follows the HCM 2000 methodologies for evaluating signalized and unsignalized intersection operations.

2.7.2 Existing Traffic Conditions & Volumes

MAJOR ROADWAYS

Several major roadways are located within the Regional Study Area. An overview of each roadway, including number of travel lanes, FHWA National Highway System designation, and existing traffic volumes, is provided below.

Route 6 is a major cross-country U.S. highway that runs east to west connecting the New Bedford and Fairhaven regions via the New Bedford-Fairhaven Bridge. East of the bridge in Fairhaven, Route 6 becomes Huttleston Avenue. Route 6 divides at Rockdale Avenue into Kempton Street as the eastbound section and Mill Street as the westbound section. Parking is allowed on Mill Street and Kempton Street. Between Rockdale Avenue and Cottage Street along Route 6 there are pavement markings designating the portion of the roadway for preferential use by bicyclists. Route 6 west of the bridge in New Bedford has a posted speed limit of 25 mph and

Route 6 east of the bridge has a posted limit of 35 mph. Route 6 is a Principal Arterial between Route 18 and Route 240. Between Route 140 and Rockdale Avenue and Purchase Street and Route 18, Route 6 is designated as an Urban Principal Arterial. Kempton Street and Mill Street are designated as a Urban Minor Arterials between Rockdale Avenue and Purchase Street.

Route 140 is a major state highway that runs north to south in New Bedford. Route 140 has two 12-foot wide lanes and a 10-foot wide shoulder in each direction. Northbound and southbound are separated by a median barrier. It connects Route 6 and I-195 in the western portion of the Local Study Area. The northbound section of Route 140 has a posted speed limit of 65 mph and the southbound section has a posted speed limit of 45 mph. Route 140 is a Principal Arterial north of Route 6.

Route 240 is a major state highway that runs north to south in Fairhaven. Route 240 has two 12-foot wide lanes and a 10-foot wide shoulder in each direction. Northbound and southbound are separated by a grass median. It connects Huttleston Avenue and I-195. The posted speed limit on the northbound section is 50 mph and 40 mph along the southbound section. Route 240 is a Principal Arterial north of Route 6.

Interstate 195 (I-195) is an interstate highway that runs east to west through New Bedford and Fairhaven. I-195 has two 12-foot wide lanes and a 10-foot wide shoulder in each direction. A median barrier divides eastbound and westbound lanes. I-195 connects Route 140 with Route 240. Route 18 also connects with I-195 near Coggeshall Street. The posted speed limit along I-195 is 55 mph.

Route 18 is a major state highway that runs north to south in New Bedford. Route 18 has three 11-foot wide lanes and a 10-foot wide shoulder in each direction. A median barrier separates northbound and southbound lanes. Route 18 connects Union Street and I-195 and passes through Route 6. The posted speed limit along Route 18 is 50 mph. Route 18 between Route 6 and I-195 is a Principal Arterial.

Main Street is a major arterial road that runs north to south in the Town of Fairhaven. Main Street has one 15-foot wide lane in each direction and it connects with Huttleston Avenue and Howland Road. Parking is allowed on most sections of Main Street between Huttleston Avenue and Howland Road. The posted speed limit along Main Street is 30 mph. Main Street is an Urban Minor Arterial.

Purchase Street is a major arterial road that runs north to south in the City of New Bedford. Purchase Street has one 16-foot wide lane in each direction, which splits into two lanes near Route 6 and Coggeshall Street. Purchase Street connects Route 6 (Kempton Street) and Coggeshall Street, and also connects with Route 18. The posted speed limit along Purchase Street is 25 mph. Purchase Street is an Urban Minor Arterial between Union Street and I-195.

Figure 2.20. Regional Study Area Intersections

EXISTING INTERSECTION GEOMETRY

Field inventories were conducted for all 36 intersections within the Regional Study Area to determine street geometry including lane widths, lane use configurations, traffic control devices, curbside regulations, parking, bus pick up and drop off locations, and permitted movements at each intersection (see Figure 2.20). The following text describes the existing intersection geometries based on field observations, Google Earth aerial imagery, and traffic signal plans provided by MassDOT. Each intersection has been given a unique identification number that is used throughout this section for consistency. Photographs and aerials of each intersection are provided throughout this section (see Figures 2.21 to 2.35).

1. **Route 6 (Kempton Street) and Route 140 (Brownell Avenue).** This is a four-legged signalized intersection with two-way Route 6 (Kempton Street) forming the eastbound and westbound approaches, Brownell Ave as the northbound approach, and Route 140 as the southbound approach. Kempton Street eastbound has one 11-foot-wide left-turn bay, 12-foot-wide through lane and 15-foot-wide through/right-turn lane. Kempton Street westbound has one 10-foot-wide left-turn bay, two 11-foot-wide through lanes and one 11-foot-wide channelized right turn lane. Brownell Avenue northbound has one 18-foot-wide left/through/right-turn lane. Route 140 southbound has one 11-foot-wide left/through lane, one 11-foot-wide through lane and one 16-foot-wide channelized right-turn lane. Kempton Street has sidewalks and raised medians on both the approaches.
2. **Route 6 (Kempton Street) and Cornell Street.** This is a three-legged signalized intersection with two-way Kempton Street forming the eastbound and westbound approaches and two-way Cornell Street forming the southbound approach. Kempton Street eastbound has one 10-foot-wide left-turn bay and two 12-foot-wide through lanes. Kempton Street westbound has one 12-foot-wide through lane and one 12-foot-wide through/right-turn lane. Cornell Street southbound has one 15-foot-wide left/right-turn lane. Kempton Street eastbound approach and Cornell Street southbound approach has a 10-foot-wide pedestrian crosswalk. Kempton Street has a raised median and a two-foot-wide shoulder on both the approaches. Both Cornell Street and Kempton Street have sidewalks. A nearside bus stop is located 50 feet from the intersection on the Kempton Street eastbound approach.

Figure 2.21. Regional Study Area Intersections 1 and 2

3. **Kempton Street and Rockdale Avenue.** This is a four-legged signalized intersection with two-way Kempton Street being the eastbound and westbound approaches and Rockdale Avenue forming the northbound and southbound approaches. Kempton Street eastbound has a 12-foot-wide left-turn bay, one 12-foot-wide through lane and a 12-foot-wide right turn lane. Kempton Street westbound has one 21-foot-wide left/through/right-turn lane. Rockdale Avenue northbound has one 12-foot-wide left-turn lane and one 12-foot-wide through/right-turn lane. Rockdale Avenue southbound has one 13-foot-wide left-turn/through/right-turn lane. All the approaches have 10-foot-wide pedestrian crosswalks, sidewalks, and bicycle symbols on the intersection approach intending the actuation of bicycle green signal. Southbound Rockdale Avenue has a 15-foot-wide angular parking lane. All the approaches have a "No Turn on Red" sign. There is a nearside bus stop on Rockdale Avenue northbound approach 80 feet away from the intersection, a far-side bus stop on Rockdale Avenue southbound 80 feet away from the intersection and a far-side bus stop on eastbound Kempton Street 110 feet away from the intersection approach.
4. **Mill Street and Rockdale Avenue.** This is a four-legged signalized intersection with one-way Mill Street forming the westbound approach and two-way Rockdale Avenue forming the northbound and southbound approaches. Mill Street westbound approach has one 12-foot-wide left/through/right-turn lane. Rockdale Avenue northbound approach has one 10-foot-wide left-turn bay and 11-foot-wide through lane. Rockdale Avenue southbound approach has one 11-foot-wide through lane and 10-foot-wide right-turn bay. All of the approaches have 10-foot-wide pedestrian crosswalks, sidewalks, and bicycle symbols on the intersection approaches intending the actuation of bicycle green signal. Southbound Rockdale Avenue has a 15-foot-wide angular parking lane after the intersection. Westbound Mill Street has a 7-foot-wide parking lane and parking is not allowed between the corner and 33 feet before the intersection. On the other side of the intersection, on westbound Mill Street, there is a 15-foot-wide striped parking lane. A nearside bus stop is located on westbound Mill Street 25 feet away from the intersection and on southbound Rockdale Avenue, 50 feet away from the intersection approach.

Figure 2.22. Regional Study Area Intersections 3 and 4

5. **Mill Street and Cottage Street.** This is a four-legged signalized intersection with one way Mill Street forming the westbound approach and two way Cottage Street forming the northbound and southbound approaches. Mill Street westbound approach has one 12-foot-wide left/through/right-turn lane. Cottage Street northbound has one 13-foot-wide left/through lane. Cottage Street southbound has one 13-foot-wide through/right-turn lane. All the approaches have 10-foot-wide pedestrian crosswalks, sidewalks, and bicycle symbols on the intersection approach intending the actuation of bicycle green signal. Westbound Mill Street has a 7-foot-wide parking lane and a 5-foot-wide shoulder. There is a nearside bus stop on westbound Mill Street approach 25 feet away from the intersection approach.
6. **Kempton Street and Cottage Street.** This is a four-legged signalized intersection with one way Kempton Street forming the eastbound approach and two way Cottage Street forming the northbound and southbound approaches. Kempton Street eastbound approach has one 10-foot-wide left-turn lane, one 11-foot-wide through lane and one 10-foot-wide right-turn lane. Cottage Street northbound approach has one 13-foot-wide through/right-turn lane. Cottage Street southbound approach has one 13-foot-wide left/through lane. All the approaches except southbound Cottage Street have 8-foot-wide pedestrian crosswalks. All the approaches have sidewalks and bicycle symbols on the intersection approach intending the actuation of bicycle green signal. Eastbound Kempton Street has a 10-foot-wide parking lane on the far side of the intersection. A nearside bus stop is located on the eastbound Kempton Street 40 feet away from the intersection approach and on the southbound Cottage Street 25 feet away from the intersection approach.
7. **Mill Street and County Street.** This is a four-legged signalized intersection with one-way Mill Street westbound approach and two way County Street northbound and southbound approaches. Mill Street westbound approach has one 12-foot-wide left/through/right-turn lane with a 5-foot-wide shoulder. County Street northbound approach has one 11-foot-wide left-turn bay and one 13-foot-wide through lane. County Street southbound approach has one 12-foot-wide through/right-turn lane. All the approaches have 10-foot-wide crosswalks, sidewalks, and bicycle symbols on the intersection approach intending the actuation of bicycle green signal. Westbound Mill Street has a 7-foot-wide parking lane on the approach as well as the receiving lane. A nearside bus stop is located on the westbound Mill Street 50 feet away from the intersection approach.
8. **Kempton Street and County Street.** This is a four-legged signalized intersection with one way Kempton Street forming the eastbound approach and two-way County Street forming the northbound and southbound approaches. Kempton Street eastbound approach has one 10-foot-wide left-turn lane, one 11-foot-wide through lane and one 10-foot-wide right-turn lane. County Street northbound approach has one 14-foot-wide through/right-turn lane. County Street southbound approach has one 14-foot-wide left/through lane. All three approaches have pedestrian crosswalks, sidewalks, and bicycle symbols on the intersection approach intending the actuation of bicycle green signal. Parking is allowed on the receiving southbound County Street and eastbound Kempton Street. A nearside bus stop is located 35 feet away from the intersection on the County Street southbound approach.

Figure 2.23. Regional Study Area Intersections 5 to 8

9. **Kempton Street/Route 6 and Purchase Street/Pleasant Street**. Locally known as the "Octopus Intersection," this is a four-legged signalized intersection with two-way Kempton Street and Route 6 forming the eastbound and westbound approaches and two-way Pleasant Street forming the northbound and Purchase Street forming the southbound approach respectively. Foster Street forms the receiving southbound approach. Kempton Street eastbound approach has one 12-foot-wide left-turn lane, one 18-foot-wide through lane and 18-foot-wide channelized right turn joining in to Foster Street. Mill Street westbound approach has one 12-foot-wide left-turn lane, one 12-foot-wide through lane and one 12-foot-wide right-turn lane. Pleasant Street northbound approach has one 15-foot-wide left-turn lane, two 15-foot-wide through lanes and one 18-foot-wide channelized right-turn lane. Purchase Street southbound approach has one 18-foot-wide left/through lane and one 15-foot-wide through/right-turn lane. Westbound and eastbound approach have raised median. All of the approaches have 8-foot-wide pedestrian crosswalks.

Figure 2.24. Regional Study Area Intersections 9, 21 and 22

10. **Route 6 (Huttleston Avenue) and Middle Street**. This is a three-legged signalized intersection with two-way Huttleston Avenue forming the eastbound and westbound approaches with raised medians and one way Middle Street forming the northbound approach. The Huttleston Avenue eastbound approach has one 12-foot-wide through lane and one 12-foot-wide through/right-turn lane. The Huttleston Avenue westbound approach has one 11-foot-wide left/through lane and one 11-foot-wide through lane. Middle Street northbound approach has one 15-foot-wide left/right-turn lane. The Huttleston Avenue eastbound approach and Middle Street northbound approach has 8-foot-wide pedestrian crosswalks. Both of the approaches to Huttleston Avenue have bicycle symbols on the intersection approach intending the actuation of bicycle green signal. There is a bus stop on westbound approach of Huttleston Avenue in the middle of the intersection.
11. **Route 6 (Huttleston Avenue) and Main Street.** This is a four-legged signalized intersection with two-way Huttleston Avenue forming the eastbound and westbound approaches and two-way Main Street forming the northbound and southbound approaches. Huttleston Avenue eastbound approach has one 10-foot-wide left-turn lane, one 11-foot-wide through lane and one 11-foot-wide through/right-turn lane. Huttleston Avenue westbound approach has one 10-foot-wide wide left-turn bay, one 11-foot-wide through lane, and one 11-foot-wide through/right-turn lane. Main Street northbound and southbound approaches have one 15-foot-wide left/through/right-turn lane each. All the approaches have 8-foot-wide pedestrian crosswalks, sidewalks, and bicycle symbols on the intersection approach intending the actuation of bicycle green signal. Raised medians are located on the eastbound and westbound Huttleston Avenue approaches and there is a far-side bus stop on the eastbound Huttleston Avenue 60 feet away from the intersection approach.
12. **Route 6 (Huttleston Avenue) and Green Street.** This is a four-legged signalized intersection with two-way Huttleston Avenue forming the eastbound and westbound approaches and two way Green Street forming the northbound and southbound approaches. Huttleston Avenue eastbound and westbound approaches have one 11-foot-wide left/through lane and one 11-foot-wide through/right-turn lane each. Green Street northbound and southbound approaches have one 13-foot-wide left/through/right-turn lane each. Huttleston Avenue has raised medians on both the approaches. All the four approaches have 8-foot-wide pedestrian crosswalks, sidewalks, and bicycle symbols on the intersection approach intending the actuation of bicycle green signal. A nearside bus stop is located 50 feet away from the intersection on the Huttleston Avenue eastbound approach and 15 feet away from the intersection on the Huttleston Avenue westbound approach.
13. **Route 6 (Huttleston Avenue) and Adams Street.** This is a four-legged signalized intersection with two-way Huttleston Avenue forming the eastbound and westbound approaches and two-way Adams Street forming the northbound and southbound approaches. Huttleston Avenue eastbound approach has one 11-foot-wide left/through lane and one 11-foot-wide through/right-turn lane and westbound approach has one 12-foot-wide left/through lane and one 12-foot-wide through/right-turn lane. The Adams Street northbound approaches have one 13-foot-wide left/through/right-turn lane and Adams Street southbound has one 15-foot-wide left/through/right-turn lane. Huttleston Avenue eastbound approach has a raised median until the intersection. All the four approaches have eight-foot-wide pedestrian crosswalks, sidewalks, and bicycle symbols on the intersection approach intending the actuation of bicycle green signal. There is a four-foot-wide shoulder on the westbound approach of the Huttleston Avenue and a one-foot-wide shoulder on the

eastbound approach on both sides. There is a nearside bus stop 50 feet away from the intersection on each of the eastbound and westbound approaches of the Huttleston Avenue.

Figure 2.25. Regional Study Area Intersections 10 to 13

14. **Route 6 (Huttleston Avenue) and Holcomb Street.** This is a four-legged signalized intersection where the southbound approach is driveway to a parking lot. Huttleston Avenue forms the eastbound and westbound approaches and Holcomb Street forms the northbound and approach. Huttleston Avenue eastbound and westbound approach has one 12-foot-wide left/through lane and one 12-foot-wide through/right-turn lane each. Holcomb Street northbound approach has one 15-foot-wide left/through/right-turn lane. Holcomb Street southbound approach has one 20-foot-wide left/through/right-turn lane. All the approaches except westbound Holcomb Street have 8-foot-wide pedestrian crosswalks. All the approaches have sidewalks. There is a nearside bus stop 80 feet away from the intersection on the eastbound approach of Huttleston Avenue and a far-side bus stop 120 feet away from the intersection on the westbound Huttleston Avenue.
15. **Route 6 (Huttleston Avenue) and Bridge Street.** This is a four-legged signalized intersection with two-way Huttleston Avenue forming the eastbound and westbound approaches and two way Bridge Street forming the northbound and southbound approaches. Huttleston Avenue eastbound and westbound approaches have one 12-foot-wide left/through lane and one 12-foot-wide through/right-turn lane each. Bridge Street northbound approach is unmarked with approximately 20-foot-wide left/through/right-turn lane and southbound approach has one 13-foot-wide left/through/right-turn lane. There are pedestrian crosswalks on the northbound and southbound approaches of the Bridge Street. There is a seven-foot-wide shoulder on the westbound approach of the Huttleston Avenue and two-foot-wide shoulder on the eastbound approach of the Huttleston Avenue. There is a far-side bus stop 120 feet away from the intersection on northbound Bridge Street.

Figure 2.26. Regional Study Area Intersections 14 and 15

16. **Route 6 (Huttleston Avenue) and Alden Road.** This is a four-legged signalized intersection with two-way Huttleston Avenue forming the eastbound and westbound approaches and two way Alden Street forming the northbound and southbound approaches. Huttleston Avenue eastbound approach has one 10-foot-wide left-turn bay, one 12-foot-wide through lane and one 12-foot-wide through/right-turn lane. Huttleston Avenue westbound approach has one 11-foot-wide left-turn bay, one 11-foot-wide through lane, and one 12-foot-wide through/right-turn lane. Alden Road northbound and southbound approaches have one 12-foot-wide left/through lane and one 12-foot-wide through/right-turn lane each. All the approaches have 8-foot-wide pedestrian crosswalks and sidewalks. Huttleston Avenue eastbound and westbound approaches have raised medians. There is a four-foot-wide shoulder on the westbound approach of the Huttleston Avenue and a two-foot-wide shoulder on the eastbound approach of the Huttleston Avenue. There is a two-foot-wide shoulder on the northbound approach of the Alden Road. There is a nearside bus stop 150 feet away from the intersection on the southbound Alden Street.
17. **Route 6 (Huttleston Avenue) and Route 240 (Sconticut Neck Road).** This is a four-legged signalized intersection with two-way Huttleston Avenue forming the eastbound and westbound approaches and two-way Sconticut Neck Road forming the northbound approach and Route 240 forming the southbound approaches. Huttleston Avenue eastbound approach has one 10-foot-wide left-turn bay, two 12-foot-wide through lane and one 12-foot-wide channelized right-turn lane. Huttleston Avenue westbound approach has one 12-foot-wide left-turn bay, two 12-foot-wide through lanes, and one 12-foot-wide channelized right-turn lane. Route 240 northbound approach has one 10-foot-wide left-turn bay, two 12-foot-wide through lanes, and one 18-foot-wide channelized right-turn lane. Route 240 southbound approach has one 10-foot-wide left-turn bay, two 12-foot-wide through lanes and one 22-foot-wide channelized right-turn lane. All the approaches have 8-foot-wide pedestrian crosswalks and Huttleston Avenue eastbound and westbound approaches have bicycle symbols on the intersection approach intending the actuation of bicycle green signal.

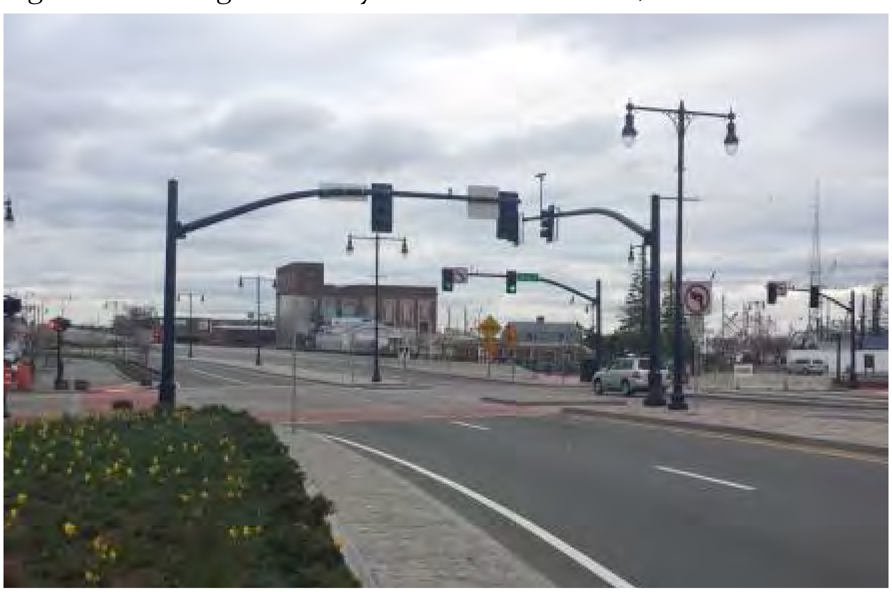
Figure 2.27. Regional Study Area Intersections 16 and 17

18. **Bridge Street and Alden Road.** This is a four-legged signalized intersection with two-way Bridge Street forming the eastbound and westbound approaches and two-way Alden Street forming the northbound and southbound approach. Bridge Street eastbound approach has one 11-foot-wide left-turn bay and one 11-foot-wide through/right-turn lane. Bridge Street westbound approach has one 11-foot-wide left-turn bay, one 11-foot-wide through lane and one 11-foot-wide right-turn lane. Alden Road northbound approach has one 12-foot-wide left-turn bay, one 12-foot-wide through lane, and one 12-foot-wide right-turn lane. Alden Road southbound approach has one 11-foot-wide left-turn bay, an 11-foot-wide through lane, and an 11-foot-wide right-turn lane. All the approaches have 2-foot-wide shoulders. Northbound approach of Alden Road and eastbound approach of Bridge Street have 10-foot-wide pedestrian crosswalks. All the approaches have bicycle symbols on the intersection approach intending the actuation of bicycle green signal.
19. **Bridge Street and Route 240.** This is a four-legged signalized intersection with two way Bridge Street forming the eastbound and westbound approaches and two way Route 240 forming the northbound and southbound approach. Bridge Street eastbound approach has one 11-foot-wide left-turn bay, one 11-foot-wide left/through lane and one 12-foot-wide right-turn bay. Bridge Street westbound approach has one 12-foot-wide left-turn bay, 12-foot-wide through lane and one 26-foot-wide channelized right-turn lane. Route 240 northbound approach has one 10-foot-wide left turn bay, two 12-foot-wide through lane, and one 10-foot-wide right-turn bay. Route 240 southbound approach has one 10-foot-wide left-turn bay, two 12-foot-wide through lanes and one 20-foot-wide channelized right-turn lane. All the approaches except the westbound approach have raised medians. All the approaches have 2-foot-wide shoulders. The northbound Route 240 approach has a 12-foot-wide pedestrian crosswalk.

Figure 2.28. Regional Study Area Intersections 18 and 19

20. **Union Street and Route 18.** This is a three-legged signalized intersection with two-way Union Street forming the eastbound approach a two-way Route 18 forming the northbound and the southbound approach. Union Street eastbound approach has one 12-foot-wide left-turn lane and one 12-foot-wide right-turn lane. There is a “No Turn on Red” sign for the eastbound approach. Route 18 northbound approach has two 12-foot-wide through lanes. Route 18 southbound approach has one 12-foot-wide through lane and one 12-foot-wide through/right-turn lane. Route 18 northbound and southbound approaches have 2-foot-wide shoulders and bicycle symbols on the intersection approach intending the actuation of bicycle green signal. All the approaches have 10-foot-wide pedestrian crosswalks.

Figure 2.29. Regional Study Area Intersection 20, View from the South



21. **Hillman Street and Purchase Street.** This is a three-legged signalized intersection with two-way Purchase Street forming the northbound and southbound approaches and one-way

Hillman Street forming the westbound approach. Purchase Street northbound has 30-foot-wide through/right-turn lane and Purchase Street southbound has 30-foot-wide through/left-turn lane. Hillman Street westbound approach has one 18-foot-wide left/right-turn lane. Westbound Hillman Street and northbound Purchase street approaches have 8-foot-wide pedestrian crosswalks and all the three approaches have sidewalks. There is a far-side bus stop 140 feet away from the intersection on the westbound Hillman Street approach and 70 feet away from the intersection on northbound Purchase Street.

22. **Hillman Street and Northbound JFK Memorial Highway on-ramp.** This is a three-legged intersection with two-way Hillman Street forming the eastbound and westbound approaches and JFK Memorial Highway on-ramp forming the receiving lane for eastbound left-turn and westbound right-turn approaches. Hillman Street eastbound approach has one 16-foot-wide left/through lane and westbound approach has one 16-foot-wide through/right-turn lane. All the approaches including the on-ramp have two-foot-wide shoulders. There is a far-side bus stop 80 feet away from the intersection on the eastbound Hillman Street.
23. **Purchase Street and Southbound JFK Memorial Highway off-ramp.** This is a three-legged intersection with two-way Purchase Street forming the flashing yellow light controlled northbound and southbound approach, and stop-controlled JFK Memorial Highway off-ramp forming the westbound approach. Purchase Street northbound and southbound approach has one 12-foot-wide through lane each and an eight-foot-wide marked parking space on both the sides of the roads. The southbound JFK Memorial Highway off-ramp westbound approach has one 30-foot-wide left/right-turn lane. There is a 10-foot-wide pedestrian crosswalk on the northbound approach.
24. **Linden Street and County Street.** This is a four-legged stop controlled intersection with two-way Linden Street forming the eastbound and westbound approaches and two-way County Street forming the northbound and southbound approaches are at an offset on Linden Street. Linden Street eastbound approach has one approximately 15-foot-wide through/right-turn lane and westbound approach has one approximately 15-foot-wide left/through lane. County Street northbound approach has one approximately 15-foot-wide left/right-turn lane. All the approaches have concrete sidewalk. Thirty-minute parking is allowed on eastbound Linden Street and 15-minute parking is allowed on northbound County Street.

Figure 2.30. Regional Study Area Intersections 23 and 24

25. **Washburn Street and Belleville Avenue.** This is a four-legged stop controlled intersection with one-way Washburn Street forming the eastbound, two-way Washburn Street forming the westbound approach and two-way Belleville Avenue forming the northbound and southbound approach. Eastbound Washburn Street has one approximately 26-foot-wide left/through/right-turn lane. Washburn Street westbound approach has one 19-foot-wide left-turn lane and one 19-foot-wide right-turn lane. Belleville Avenue northbound approach has one approximately 16-foot-wide through/right-turn lane and southbound approach has one approximately 26-foot-wide left/through lane. Parking is allowed on the eastbound Washburn Street.

Figure 2.31. Regional Study Intersections 25, 29, 30, 31, and 32

26. **Coggeshall Street and Mount Pleasant Street.** This is a four-legged stop controlled intersection with two-way Coggeshall Street forming the eastbound and westbound approaches and two-way Mount Pleasant Street forming the northbound and southbound approaches. Coggeshall eastbound and westbound approaches have 16-foot-wide left/through/right-turn lane each and Mount Pleasant northbound and southbound approaches each have 16-foot-wide left/through/right-turn lanes. There is parking allowed on both sides of the road on eastbound and westbound approaches of Coggeshall Street and southbound approach of Mount Pleasant Street. There is a nearside bus stop 25 feet away from the intersection on the southbound Mount Pleasant Street approach and 15 feet away from the intersection on the northbound Mount Pleasant Street approach.
27. **Coggeshall Street and County Street.** This is a four-legged signalized intersection with Coggeshall Street forming the eastbound and westbound approaches, and County Street forming the northbound and southbound approaches. Coggeshall Street eastbound and westbound approaches have 17-foot-wide left/through/right-turn lane and County Street northbound and southbound approaches have 17-foot-wide left/through/right-turn lane. All the approaches have eight-foot-wide pedestrian crosswalks and sidewalks. There is a nearside bus stop 15 feet away from the intersection on the southbound County Street approach. Parking is allowed on the southbound approach of the County Street and eastbound approach of Coggeshall Street.

28. **Coggeshall Street and Purchase Street**. This is a four legged stop controlled intersection with two-way Coggeshall Street forming the eastbound and westbound approaches and Purchase Street forming the northbound and southbound approaches. Coggeshall Street eastbound and westbound approaches have 17-foot-wide left/through/right-turn lane. Purchase Street northbound approach and southbound approach have one 17-foot-wide left/through/right-turn lane. All the approaches have 8-foot-wide pedestrian crosswalks and sidewalks. There is a bus stop at the intersection on northbound and southbound approaches of Purchase Street. A school is located at the southwest corner of the intersection.

Figure 2.32. Regional Study Intersections 26 to 28

29. **Coggeshall Street and Ashley Boulevard.** This is a four-legged signalized intersection with two-way Coggeshall Street forming the eastbound and westbound approaches and one way Ashley Boulevard forming the southbound approach. Coggeshall Street eastbound and westbound approaches have 18- and 16-foot-wide left/through/right-turn lanes, respectively. Ashley Boulevard southbound approach has one 11-foot-wide left/through lane, one 11-foot-wide through lane and one 10-foot-wide right-turn lane. All the three approaches have eight-foot-wide pedestrian crosswalks and sidewalks. Parking is allowed on westbound Coggeshall Street.
30. **Coggeshall Street and Acushnet Avenue**. This is a four-legged signalized intersection with two way Coggeshall Street forming the eastbound and westbound approaches and one way Acushnet Avenue forming the northbound approach. Coggeshall Street eastbound approach has one 12-foot-wide left-turn lane and one 11 -foot-wide through lane. Coggeshall Street westbound approach has one 11-foot-wide through/right-turn lane. Acushnet Avenue northbound approach has one 12-foot-wide left-turn lane, one 12-foot-wide through lane and one 12-foot-wide right-turn lane. All the approaches have 8-foot-wide pedestrian crosswalks and sidewalks. There is a five-foot-wide bicycle lane on the other side of the intersection on the northbound approach. Marked parking spaces are located on both the sides of the eastbound and westbound of Coggeshall Street.
31. **Coggeshall Street and North Front Street.** This is a four legged stop controlled intersection with two-way Coggeshall Street forming the eastbound and westbound approaches and one-way stop controlled North Front Street forming the northbound approach. Coggeshall Street eastbound and westbound approaches have one 16-foot-wide

left/through/right-turn lane each. North Front Street northbound approach has one 13-foot-wide left/through/right-turn lane. All the approaches have eight-foot-wide pedestrian crosswalks and sidewalks. There is a nearside bus stop 35 feet away from the intersection on the North Front Street northbound approach. Parking is allowed on both Coggeshall Street and North Front Street.

32. **Coggeshall Street and Belleville Avenue.** This is a four-legged signalized intersection with two-way Coggeshall Street forming the eastbound and westbound approaches and two-way Belleville Avenue forming the northbound and southbound approaches. Coggeshall Street eastbound approach has one 10-foot-wide left-turn lane and one 10-foot-wide through/right-turn lane. Coggeshall Street westbound approach has one 10-foot-wide left-turn bay, one 10-foot-wide through lane and one 10-foot-wide right-turn lane. Belleville Avenue northbound approach has one 10-foot-wide left/through lane and one 10-foot-wide right-turn lane. Belleville Avenue southbound approach has on an 11.5-foot-wide left/through lane and an 11.5-foot-wide through/right-turn lane. All the approaches have eight-foot-wide pedestrian crosswalks and sidewalks. Parking is allowed on southbound Belleville Avenue.
33. **Coggeshall Street and Westbound I-195 off-ramp**. This is a four-legged signalized intersection with two-way Coggeshall Street forming the eastbound and westbound approaches and two-way WB I-195 off-ramp forming the northbound and southbound approaches. Coggeshall Street eastbound approach has one 10-foot-wide left turn lane, one 11-foot-wide through lane and one 11-foot-wide channelized right-turn lane. Coggeshall Street westbound approach has one 10-foot-wide left turn lane and one 11-foot-wide through/right-turn lane. The westbound I-195 off-ramp northbound approach has one 12-foot-wide left turn lane, one 12-foot-wide through lane and one 12-foot-wide through/right-turn lane. The westbound I-195 off-ramp southbound approach has one 11-foot-wide left-turn lane, one 11-foot-wide through lane and one 11-foot-wide right-turn bay. There is an 8-foot-wide pedestrian crosswalk on the southbound approach of WB I-195 off-ramp. There is a four-foot-wide shoulder on the westbound approach of Coggeshall Street and a two-foot-wide shoulder on the eastbound approach of the Coggeshall Street and southbound approach of the I-195 off-ramp.

Figure 2.33. Regional Study Intersection 33

34. **Howland Road and Main Street.** This is a four-legged signalized intersection with two-way Howland Road forming the eastbound and westbound approaches and two way Main

Street forming the northbound and southbound approaches. Howland Road eastbound and westbound approaches have one 12-foot-wide left/through/right-turn lane each. Main Street northbound and southbound approaches have one 15-foot-wide and one 13-foot-wide left/through/right-turn lane, respectively. Main Street northbound and southbound approaches have bicycle symbols on the intersection approach intending the actuation of bicycle green signal. All the approaches have eight-foot-wide pedestrian crosswalks and sidewalks. There is a 4-foot-wide shoulder on both sides of the eastbound Howland Road approach. Parking is allowed on southbound Main Street approach.

35. **Howland Road and Adams Street.** This is a four-legged signalized intersection with two-way Howland Road forming the eastbound and westbound approaches and two way Adams Street forming the northbound and southbound approaches. Howland Road eastbound and westbound approaches have one 12-foot-wide left/through/right-turn lane each. Adams Street northbound and southbound approaches have one 13-foot-wide and one 15-foot-wide left/through/right-turn lanes, respectively. Adams Street northbound and southbound approaches have bicycle symbols on the intersection approach intending the actuation of bicycle green signal. All the approaches have eight-foot-wide pedestrian crosswalks and sidewalks. There is a nine-foot-wide parking lane on the eastbound approach of the Howland Road. There is a two-foot-wide shoulder on the northbound approach of the Adams Street.

Figure 2.34. Regional Study Intersections 34 and 35

36. **Howland Road and Alden Road.** This is a four legged stop controlled intersection with two-way Howland Road forming the eastbound approach and westbound approach called Nancy Street and two-way Alden Road forming northbound and southbound approaches. Howland Road eastbound approach has one 11.5-foot-wide left/through/right-turn lane. Nancy Street westbound approach has one 12-foot-wide left/through/right-turn lane. Alden Road northbound and southbound approaches have 12-foot-wide left/through/right-turn lane each. Howland Road eastbound approach and southbound approach of Alden Road has 8-eight-foot-wide pedestrian crosswalks and sidewalks. Howland Road eastbound approach has a 4-foot-wide shoulder on both side of the road and Alden Road northbound and southbound approach has five-foot-wide shoulders on both sides of the road.

Figure 2.35. Regional Study Intersection 36, View from South

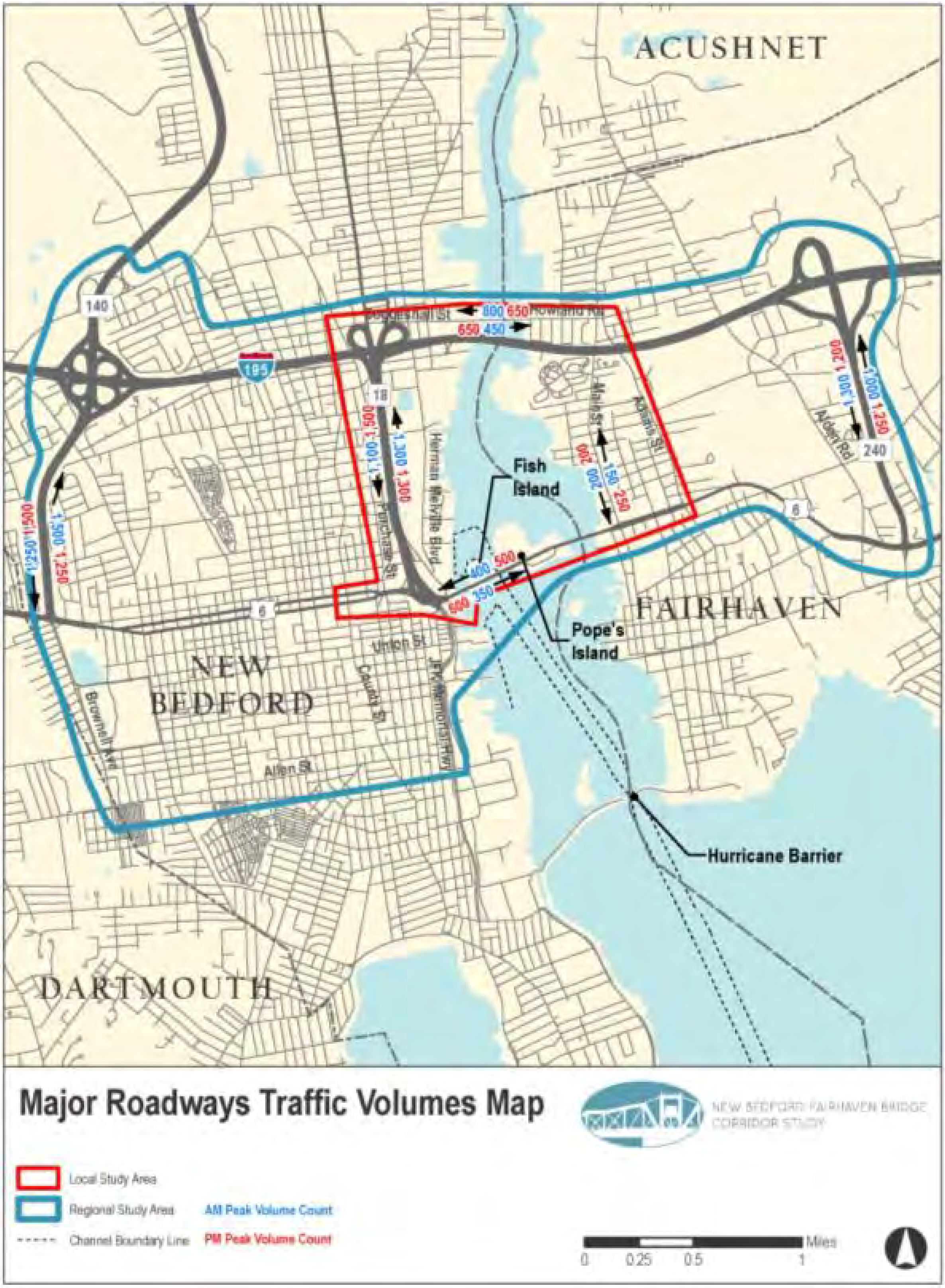
TRAFFIC VOLUMES

As discussed in Traffic Counts part of Section 2.7.1, traffic volumes were collected during the AM and PM peak periods for bridge closure and open conditions in April 2014. The traffic counts for the AM and PM peak hours for both conditions are shown in Figure 2.20. More detailed counts for the major intersections in the Regional Study Area are shown in Appendix C. Within the Regional Study Area, Route 140, Route 240, and Route 18 are the major thoroughfares in the north-south directions and Coggeshall Street is the major east-west roadway. Though the traffic on the New Bedford-Fairhaven Bridge is comparable to Coggeshall Street bridge in the PM peak hour, it is considerably lower in the AM peak hour. This could be due to the delays associated with the bridge closures or construction-related lane closures. The representative traffic volumes along major roadways within the Regional Study Area for the AM and PM peak hours are listed in Table 2.18 and shown on Figure 2.36.

Table 2.18. Representative Peak Hour Traffic Volumes along Major Roadways, 2014

Major Roadway	AM Peak Hour EB	AM Peak Hour WB	AM Peak Hour NB	AM Peak Hour SB	PM Peak Hour EB	PM Peak Hour WB	PM Peak Hour NB	PM Peak Hour SB
Route 6	350	400	-	-	600	500	-	-
Route 140	-	-	1500	1250	-	-	1250	1500
Route 240	-	-	1000	1300	-	-	1250	1200
Route 18	-	-	1300	1100	-	-	1300	1500
Main St	-	-	150	200	-	-	250	200
Coggeshall St Bridge	450	800	-	-	650	650	-	-

Figure 2.36. Representative Peak Hour Traffic Volumes along Major Roadways, 2014



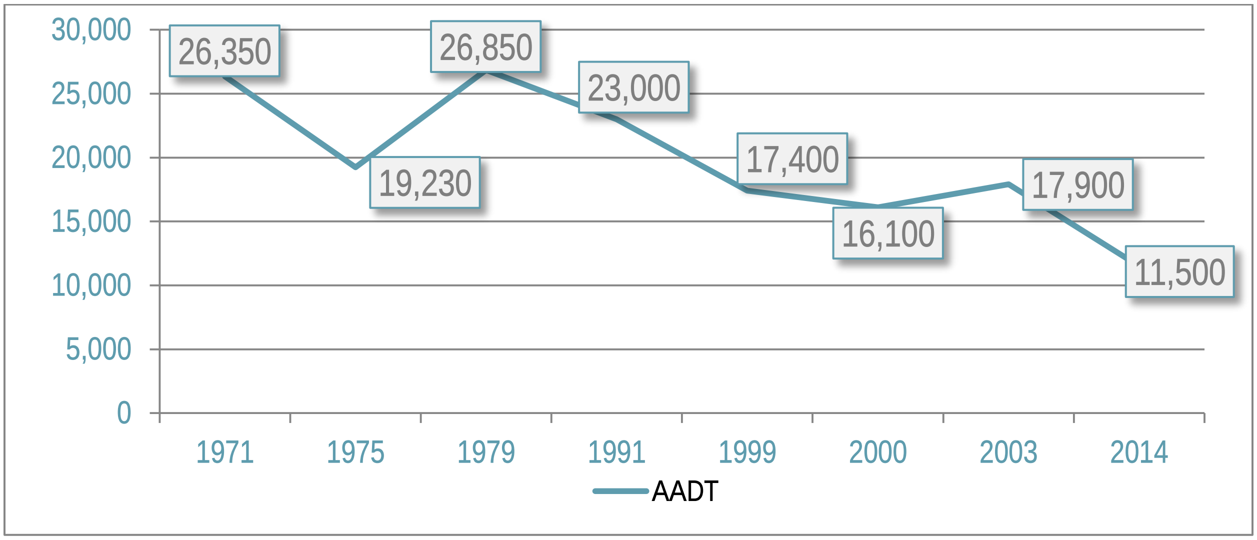
The 2014 traffic counts collected during the bridge closure were compared to traffic counts collected during the bridge open condition. Several roadways and intersections experienced higher volumes, while some saw decreased volumes. The following observations were made:

- The Coggeshall Street bridge traffic counts during bridge closure were 38 percent higher in the AM and 25 percent higher in the PM peak periods as compared to bridge open condition.
- Traffic volumes were also higher on Route 240, Main Street, Purchase Street, and Route 18 during the bridge closure.
- Traffic counts from the Route 18 on ramp and off ramp located immediately north of the New Bedford-Fairhaven Bridge are higher by 22 percent in both AM and PM peak periods.
- Main Street at Huttleston Avenue traffic counts during bridge closure were higher by 36 percent and 48 percent in the AM and PM peak periods, respectively.
- Westbound Route 6 in New Bedford and northbound Route 140 experienced reduced volume during the closure. Northbound Route 140 traffic counts during bridge closure were lower by 18 percent and 29 percent in the AM and PM peak periods respectively as compared to the bridge open condition.
- The intersection of Pleasant Street, Kempton Street, Mill Street, Sixth Street, and Route 6 in New Bedford (i.e., "Octopus Intersection"), experienced increased traffic turning left onto northbound Purchase Street from eastbound Kempton Street.

As shown in Figure 2.37, annual traffic volumes on the New Bedford-Fairhaven Bridge have been declining for the last 40 years. Regional traffic on Route 6 was affected by the opening of I-195 between New Bedford and Wareham in 1974. Bridge traffic counts from 2014 indicate that local traffic has also shifted to alternative routes, including I-195 and Coggeshall Street/Howland Road. The 2014 traffic counts indicate that Coggeshall Street/Howland Road experienced higher traffic volumes than the New Bedford-Fairhaven Bridge when the bridge was both open and closed to vehicular traffic.

It was also noted that traffic queues due to bridge openings are a significant issue in the corridor. During the AM peak period, it was observed that the westbound queue due to bridge closure reaches the Dunkin' Donuts driveway and was about 1,300 feet long. The eastbound queue was observed to extend until the Route 18 southbound off-ramp, which is approximately 1,600 feet from the stop line. During the PM peak period, the westbound queue was noted as approximately 2,350 feet long. Although there are no observations available for the eastbound direction, the high traffic volumes during the PM period can potentially result in queues that will extend beyond the Route 18 off-ramps and reach Route 18, as well as the "Octopus Intersection."

Figure 2.37. New Bedford-Fairhaven Bridge Annual Traffic Volumes, 1971 to 2014



Sources: 1985 EA, MassDOT, SRPEDD, 2014 ATR Traffic Counts
** Bridge under construction (lane restriction) during 2014 count*

2.7.3 Capacity Analysis

Most of the intersections within the Regional Study Area operate at an acceptable LOS. However, a sizeable subset has one or more lane groups that operate above the HCM defined delay threshold during one or more peak hours. An acceptable mid-LOS D is defined as 45 seconds of delay for signalized intersections and 30 seconds of delay for non-signalized intersections.

During the AM peak hour, seven of the 36 intersections operate with overall intersection average vehicle delay values above the delay threshold. An additional eight intersections have one or more lane groups that exceed the delay threshold. Thus a total of 15 of the 36 intersections currently have an approach or the entire intersection operating at a delay that exceeds the threshold in the AM peak hour.

During the PM peak hour, ten of the 36 intersections operate with overall intersection average vehicle delay values above the delay threshold. An additional seven intersections have one or more lane groups that exceed the delay threshold. Thus, a total of 17 of the 36 intersections currently have an approach or the entire intersection operating at a delay that exceeds exceed the HCM threshold in the PM peak hour.

The delay and LOS results are summarized in Table 2.19. A graphical representation of the LOS at all study intersections is shown on Figure 2.38. Detailed delay and LOS tables are provided in Appendix A.

Figure 2.38. Regional Study Area Intersection LOS, 2014

Table 2.19. Intersection Delay and LOS Summary, 2014

ID #	Intersection Name	AM Int. Delay	AM Int. LOS	PM Int. Delay	PM Int. LOS
1	Kempton St & Brownell Ave/Route 140	54.9	D	63.9	E
2	Kempton St & Cornell St	11	B	9	A
3	Kempton St & Rockdale Ave	53.8	D	56.8	E
4	Mill St & Rockdale Ave	16.8	B	16.8	B
5	Mill St & Cottage St	17.6	B	16.5	B
6	Kempton St & Cottage St	20.8	C	14.4	B
7	Mill St & County St	20.6	C	23.3	C
8	Kempton St & County St	15.4	B	14.6	B
9	Kempton St/Mill St & Purchase St	73.5	E	80.7	F
10	Huttleston Ave & Middle St	9	A	10.3	B
11	Huttleston Ave & Main St	25	C	26.8	C
12	Huttleston Ave & Green St	12.1	B	10.4	B
13	Huttleston Ave & Adams St	26	C	16.7	B
14	Huttleston Ave & Holcomb St	7	A	7.1	A
15	Huttleston Ave & Bridge St	15.1	B	17.8	B
16	Huttleston Ave & Alden Rd	28.36	C	39.8	D
17	Huttleston Ave & Route 240	20.7	C	20	C
18	Bridge St & Alden Rd	44	D	51.8	D
19	Bridge St & Route 240	114.8	F	51.4	D
20	Union St & Route18	2.3	A	2.4	A
21	Hillman St & Purchase St	11.2	B	12.8	B
22	Hillman St & NB JFK Memorial Hwy on-ramp	-	-	-	-
23	Purchase St & SB JFK Memorial Hwy off-ramp	25.9	D	18.8	C
24	Linden St & County St	10.8	B	14.3	B
25	Washburn St & Belleville Ave	26.3	D	107.3	F
26	Coggeshall St & Mt. Pleasant	11.7	B	12.2	B
27	Coggeshall St & County St	12.2	B	13.1	B
28	Coggeshall St & Purchase St	170	F	14.7	B
29	Coggeshall St & Ashley Blvd	21.9	C	48.9	D
30	Coggeshall St & Acushnet Ave	18.1	B	19.6	B
31	Coggeshall St & N Front St	7.2	A	58.2	F
32	Coggeshall St & Belleville Ave	27.6	C	28.9	C
33	Coggeshall St & 195 off-ramp	56.6	E	64.3	E
34	Howland Rd & Main St	50.8	D	124.7	F
35	Howland Rd & Adams St	41.4	D	39	D
36	Howland Rd & Alden Rd	4.2	A	5.6	A

Source: HCM 2000 based Synchro outputs

2.7.4 Safety

The most recent crash data obtained from MassDOT was for the years 2009, 2010, and 2011. This crash data was reviewed to identify crashes involving fatalities, bicycles, or pedestrians within the Regional Study Area and more closely for the overall crashes within the local study area. As shown in Figure 2.39, there were 11 fatal crashes within the Regional Study Area between 2009 and 2011. Of the 11 fatal crashes, three occurred within the Local Study Area. Two fatal crashes involved pedestrians. No fatal crashes involved bicycles. Descriptions of the fatal crashes in the Local Study Area are provided in Table 2.20. Descriptions of the fatal crashes in the Regional Study Area are provided in Table 2.21.

Table 2.20. Fatal Crashes within Local Impact Study Area, 2009-2011

No.	Date	Time	Location	Description
1	August 8, 2009	2:46 AM	New Bedford-Fairhaven Bridge	A light truck travelling eastbound collided with a guiderail
2	June 15, 2010	6:03 AM	Intersection of Washburn Street and Belleville Avenue	A tractor trailer traveling eastbound collided with the motorcycle traveling southbound
3	October 29, 2010	3:30 PM	Intersection of Route 6 and Pleasant Street	A light truck traveling eastbound turning left at the intersection collided with a pedestrian*

Source: MassDOT

Table 2.21. Fatal Crashes within Regional Study Area, 2009-2011

No.	Date	Time	Location	Description
1	May 22, 2009	8:00 AM	New Bedford-Fairhaven Bridge	A motorcycle traveling eastbound collided with a movable object
2	July 21, 2009	9:12 AM	Elm Street near SRTA Terminal	A bus traveling eastbound turning left collided with a pedestrian*
3	August 31, 2009	12:47 PM	Intersection of Elm Street and Purchase Street	A car traveling westbound turning left collided with a pedestrian*
4	September 27, 2009	8:20 PM	Route 18 off ramp at Purchase Street	Two cars and one light truck traveling southbound collided when one car was changing lanes and the other car and light truck were traveling straight
5	November 12, 2010	11:02 PM	Northbound County Street and Merrimac Street	A car traveling Northbound County Street collided with a pedestrian
6	December 22, 2010	5:19 PM	Northbound Jenny Lind Street, south of Route 6	A light truck traveling northbound collided with a pedestrian while backing up*
7	April 12, 2011	9:04 PM	Intersection of Willis Street and Purchase Street	A car traveling eastbound turning left collided with a car traveling southbound
8	August 19, 2011	1:08 AM	Intersection of Acushnet Avenue and Washburn Street	A car traveling Northbound Acushnet Ave collided with a utility pole

**Fatal crash involving pedestrians.*
Source: MassDOT

Figure 2.39. Fatal Crash Locations, 2009-2011

Figure 2.40 shows the locations of crashes involving bicycles and pedestrians. Figure 2.40 also includes a table of the number of crashes involving bicycles and pedestrians between 2009 and 2011 within the Regional Study Area. Seventy-three total crashes occurred during the three-year period. Seven of the 51 crashes involving pedestrians and six of the 22 crashes involving bicycles occurred along the Route 6 corridor within the limits of the Regional Study Area.

The crash data along the Route 6 corridor between County Street in New Bedford and Green Street in Fairhaven was analyzed and the number of crashes by severity and collision type is listed in Tables 2.22 and 2.23, respectively.

Table 2.22. Crashes by Severity within Local Impact Study Area, 2009-2011

No.	Severity	2009	2010	2011	Total
1	Fatal injury	2	1	0	3
2	Non-fatal injury	21	21	24	66
3	Property damage only (none injured)	50	61	52	163
4	Not Reported	1	1	1	3
5	Unknown	2	2	0	4
	Total	76	86	77	239

Source: MassDOT

Table 2.23. Crashes by Collision Type within Local Impact Study Area, 2009-2011

No.	Collision Type	2009	2010	2011	Total
1	Angle	35	36	31	102
2	Head-on	0	3	2	5
3	Not reported	0	0	0	0
4	Rear-end	27	18	24	69
5	Rear-to-rear	0	0	1	1
6	Sideswipe, opposite direction	0	1	2	3
7	Sideswipe, same direction	7	5	7	19
8	Single vehicle crash	6	21	9	36
9	Unknown	1	2	1	4
	Total	76	86	77	239

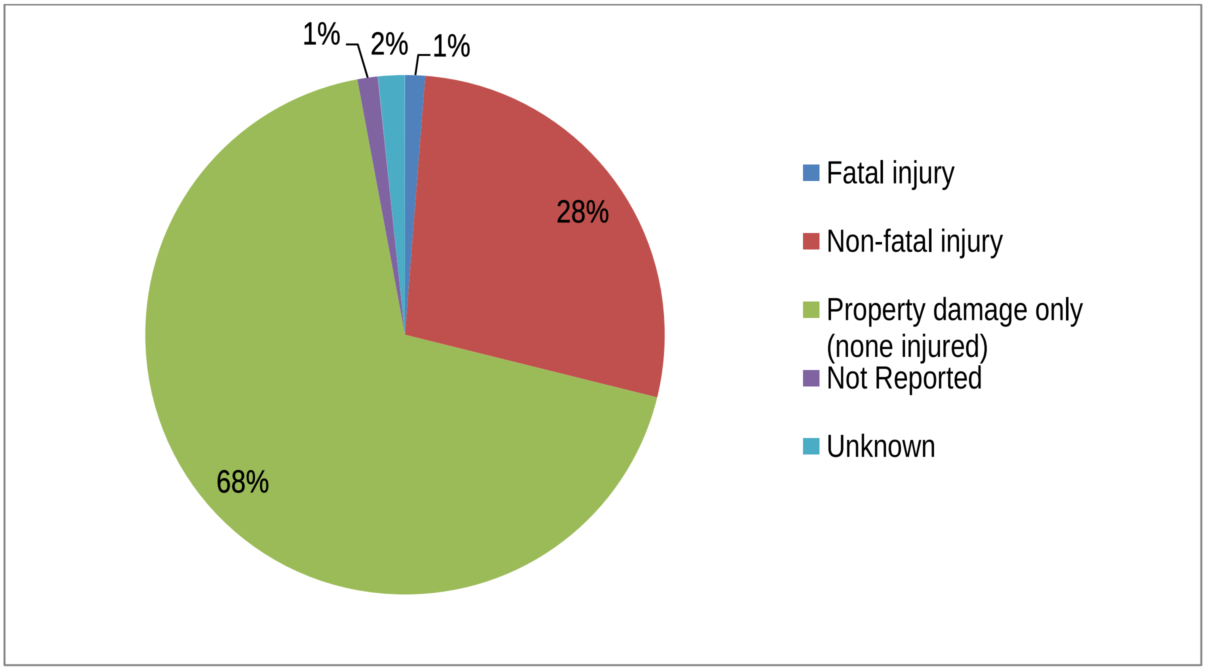
Source: MassDOT

The information in Tables 2.22 and 2.23 is represented as percentages in Figures 2.41 and 2.42, respectively. As shown in Table 2.22 and Figure 2.41, 68 percent of accidents involved only property damage. Approximately 28 percent of accidents involved non-fatal injuries and 1 percent of accidents involve fatal injuries. As shown in Table 2.23 and Figure 2.42, the majority of crashes occurred due to angle collision (43 percent), rear-end collision (29 percent), or single vehicle collision (15 percent).

Figure 2.40. Locations of Bicycle and Pedestrian Crashes

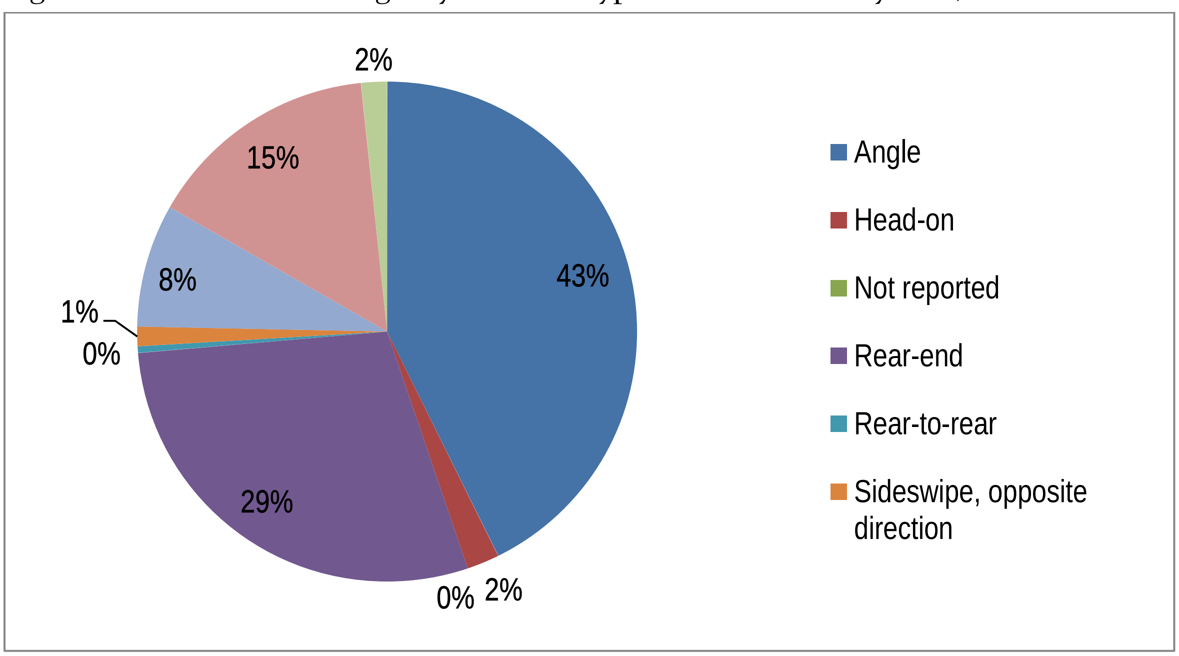
City	BICYCLE CRASHES FY2009	FY2010	FY2011	TOTAL	PEDESTRIAN CRASHES FY2009	FY2010	FY2011	TOTAL
New Bedford	4	4	5	13	11	18	18	47
Fairhaven	1	3	5	9	1	0	3	4

Figure 2.41. Crash Percentages by Severity within Local Impact Study Area, 2009-2011



Source: MassDOT

Figure 2.42. Crash Percentages by Collision Type within Local Study Area, 2009-2011



Source: MassDOT

The majority of angle collisions occurred at intersection approaches between turning vehicles and vehicles traveling straight. Among the angle collisions that occurred along the New Bedford-

Fairhaven Bridge, a majority occurred due to vehicles slowing while queuing, turning left, or changing lanes.

Approximately 60 of the 69 rear-end crashes that occurred on the New Bedford-Fairhaven Bridge were in slow-moving traffic. This is potentially due to the queuing that occurs when the bridge is closed to traffic. Most of these crashes caused property damage only and there were no fatal injuries involved.

Most of the single vehicle crashes occurred on the New Bedford-Fairhaven Bridge. These crashes involved vehicles colliding with physical objects such as trees, guiderails, medians, curbs, bridge overhead structures, or other movable objects. There were two fatal crashes on the New Bedford-Fairhaven Bridge due to a single vehicle colliding with a movable object and guiderail. After construction activity along the bridge is completed and construction objects such as guiderails, median barriers, and other equipment are removed, a reduction in the number of single vehicle collisions can be expected.

2.7.5 ITS

In the event of bridge closures to traffic, drivers are informed of the closure using Intelligent Transportation Systems (ITS) signs such as the ones shown in Figure 2.43 below. All signs are ground-mounted except for one sign, which is mounted on a signal mast arm. Five signs are located west of the bridge and three signs are located east of the bridge. Three of the five signs west of the bridge are located at the intersection of Kempton Street and Purchase Street. Two of the five signs west of the bridge are located along Route 18. The three signs located east of the bridge are installed at the intersection of Huttleston Avenue and Main Street, one of which is installed on a signal mast arm. Figure 2.44 illustrates the approximate locations of the ITS signs.

In the event of bridge closure, all signs display 'CLOSED.' The signs are turned on or off by a radio signal sent by the bridge operator. The existing signs, which were installed in 1996, use now outdated technology that is difficult to repair. SRPEDD recently completed an ITS study in October 2014 to evaluate the existing system. MassDOT is proceeding with plans to replace the existing signs.

The bridge is closed to traffic approximately once every hour during rush hours. The duration of bridge closure to traffic is approximately 11.5 minutes. As mentioned in Table 2.2 and observed in the field, the bridge is closed at about 8:00 AM and 4:15 PM during AM and PM peak hours, respectively.

By reviewing the traffic count data in 15-minute intervals, a decrease in the bridge traffic was observed on the approaches where ITS signs are displayed during the interval when the bridge is closed. The decrease in traffic is approximately 60 percent during the AM peak hour and 25 percent during the PM peak hour. This shows a higher delay tolerance in the drivers during PM peak hours despite a high overall volume on the roadway network.

These percentages also represent a compliance rate of ITS signs that reflect the driver's choice of alternate paths during bridge closure. Despite a compliance rate as high as 60 percent during the AM peak hour, the queues are as long as 1,300 feet and 1,600 feet in the westbound and eastbound directions, respectively. The high westbound queues (2,350 feet) during the PM peak hour when there is a low ITS sign compliance highlights the importance of considering new ITS signs and/or relocating existing ITS signs.

In the future conditions analysis, the location and types of ITS signs will be evaluated and adjusted to provide detours along streets during the bridge closure condition to minimize delay.

Figure 2.43. Examples of Bridge ITS

Ground-mounted ITS sign near the "Octopus Intersection" in New Bedford.

ITS sign located on mast arm in Fairhaven.

Figure 2.44. Bridge ITS Location Map

2.8 TRANSIT

2.8.1 Existing Service

The Southeastern Regional Transit Authority (SRTA) provides bus transit service in New Bedford and Fairhaven. As shown in Figure 2.45, several bus routes operate within the Local Study Area and along portions of the corridor, but none currently crosses over the bridge. The downtown New Bedford Bus Terminal is located just outside the Local Study Area near New Bedford City Hall.

According to the *New Bedford Transit Development Plan* (TDP) prepared in December 2011, the SRTA bus routes provide service to areas identified as having higher proportions of transit dependent populations. The City of New Bedford's major employment, retail, and educational services, including the port and downtown, are located within SRTA's service area. In 2014, SRTA completed a Comprehensive Service Assessment (CSA) that evaluated each route and the service as a whole. This CSA will be used by the agency to guide transit improvements and changes over the coming years.

The majority of the 10 SRTA bus routes that operate in the Local Study Area run between 6 AM and 6 PM on weekdays and Saturday. Headways for each of the bus routes, and the start and end locations for each route, is provided in Table 2.24.

Currently, bus service is not provided over the New Bedford-Fairhaven Bridge due in part to the scheduling unreliability from frequent bridge openings. In the past, SRTA Route 11 crossed the bridge along Route 6 between the downtown New Bedford transit hub and shopping centers in Fairhaven. In 2013 the route was rerouted to travel up Main Street in Fairhaven to Howland Road/Coggeshall Street, and connects back to downtown New Bedford along Front Street/Herman Melville Boulevard.

Table 2.24. SRTA Bus Routes in Regional Study Area, 2014

Bus Route	Start Location	End Location	Headway (min)
Route 1 - Fort Rodman	- New Bedford Terminal - Brook Ave and Coral	- Brook Ave and Coral - New Bedford Terminal	- 20 - 20
Route 2 - Lund's Corner	- New Bedford Terminal - Lund's Corner	- Lund's Corner - New Bedford Terminal	- AM -12; PM -20 - 20
Route 3 - Dartmouth St.	- New Bedford Terminal - Big Value Plaza (Sol E Mar Street and Dartmouth Street)	- Big Value Plaza (Sol E Mar Street and Dartmouth Street) - New Bedford Terminal	- 30 - 30
Route 4 - Ashley Boulevard	- New Bedford Terminal - Trucchi's	- Trucchi's - New Bedford Terminal	- 30 - 30
Route 5 - River St.	- New Bedford Terminal - Stop & Shop (Rockdale Ave and Hemlock Street)	- Stop & Shop (Rockdale Avenue and Hemlock Street) - New Bedford Terminal	- 45 - 45

Bus Route	Start Location	End Location	Headway (min)
Route 6 - Shawmut/ Rockdale	- New Bedford Terminal - Stop & Shop (Rockdale Avenue and Hemlock Street)	- Stop & Shop (Rockdale Avenue and Hemlock Street) - New Bedford Terminal	- 45 - 45
Route 8 - Mt. Pleasant	- New Bedford Terminal - Field Stone Market Place	- Field Stone Market Place - New Bedford Terminal	- 45 - 45
Route 9 - New Bedford/Fall River	- New Bedford Terminal - Fall Terminal	- Fall River Terminal - New Bedford Terminal	- 60 - 61
Route 10 - Dartmouth Mall	- New Bedford Terminal - Dartmouth Mall	- Dartmouth Mall - New Bedford Terminal	- 62 - 63
Route 11 - Fairhaven	- New Bedford Terminal - Stop & Shop (Huttleston Avenue and Sconticut Neck Road)	- Stop & Shop (Huttleston Avenue and Sconticut Neck Road) - New Bedford Terminal	- 35 - 30

Source: SRTA

2.8.2 Planned Improvements

SOUTH COAST RAIL

The South Coast Rail project is the proposed restoration of commuter rail service between Boston's South Station, Fall River, and New Bedford. The proposed route would extend the commuter rail service from the route's current terminus in Stoughton and would terminate at a new station in New Bedford located within the Local Study Area. As described in the 2009 *South Coast Rail Economic Development and Land Use Corridor Plan* (South Coast Rail Corridor Plan), the proposed Whale's Tooth Station would restore passenger commuter rail to the City of New Bedford and maximize on the economic and environmental benefits of rail investment to the city and the region.

The project is currently transitioning from conceptual planning and environmental review to permitting and design. Some rail improvements including track work, grade crossings, and the design for the replacement or repair of four railroad bridges, including the Wamsutta Bridge in New Bedford are underway. Improvements to the track and bridges will allow for continued use for freight service and allow the extension of passenger service in the future. The replacement of Wamsutta Bridge is anticipated for completion in fall 2016.

Figure 2.45. Existing Transit Service

The South Coast Rail Corridor Plan designated 30 different Priority Development Areas (PDA) within the overall region. These areas are specific locations that have the greatest capacity or potential to accommodate and support new development such as major downtowns, employment centers, and future station areas. The entire New Bedford portion of the Local Study Area falls within a Priority Development Area, including the waterfront, the area around the proposed Whale's Tooth Station, and downtown New Bedford.

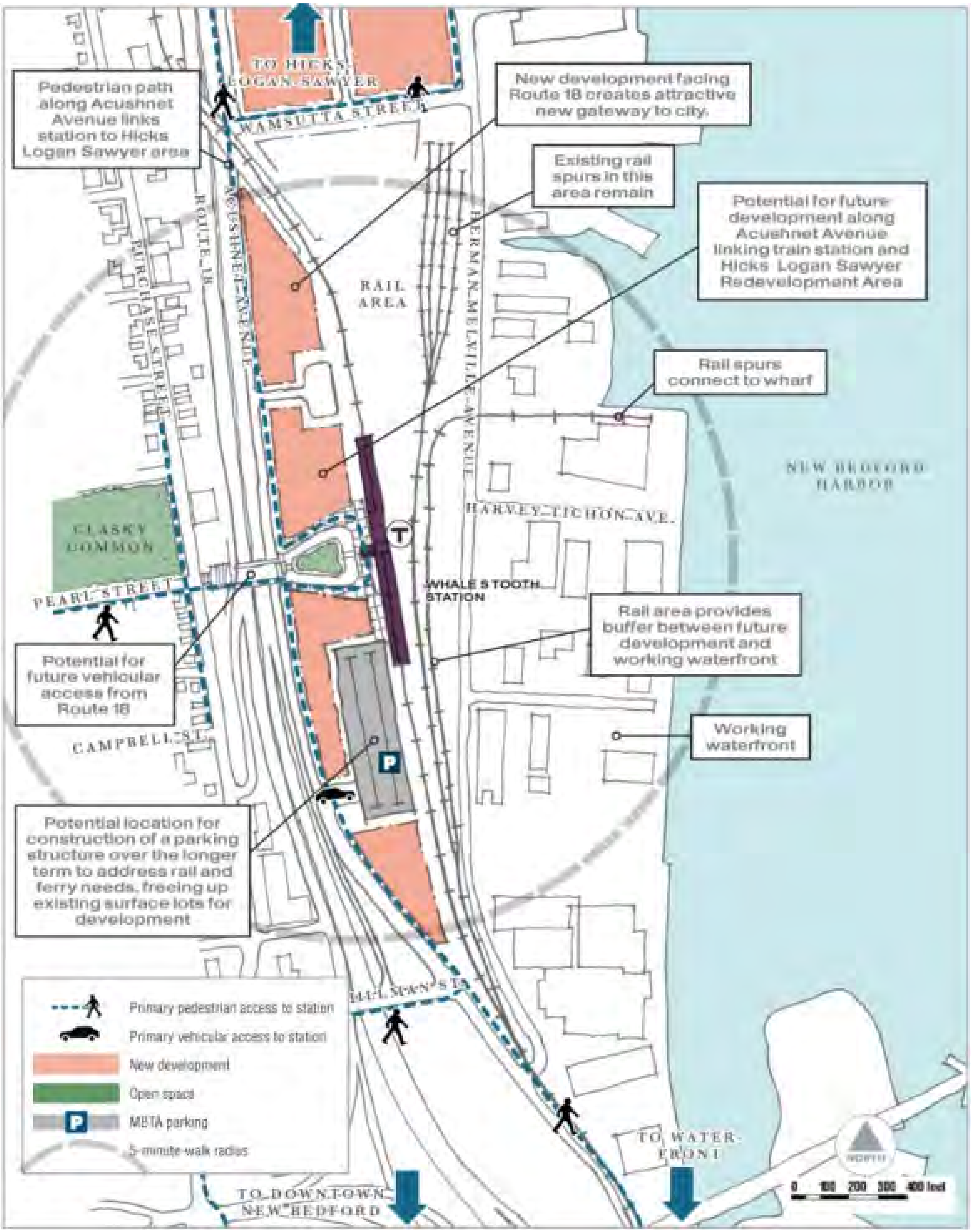
According to the South Coast Rail Corridor Plan, the area around the Whale's Tooth Station has the potential to become a transit-oriented development (TOD) intermodal center. The plan includes a concept plan for the Whale's Tooth Station area, shown in Figure 2.46, that provides a framework for the integration of the rail station with area land uses. The plan includes connections between the station and the working waterfront between Route 6 and I-195, the Route 6 corridor, and mixed-use redevelopment in downtown New Bedford, the Hicks-Logan-Sawyer District, and the residential areas west of Route 18. The plan indicates that enhancements are needed to improve local pedestrian access and transit bus service between the station area and adjoining neighborhoods.

BUS TRANSIT

As the vision for transit service in New Bedford, the 2011 TDP offered numerous recommendations for short-term transit improvements. In anticipation of the South Coast Rail expansion into the city, the plan includes recommendations to improve existing transit operations and establish a strategy to integrate future rail service and local bus service. The plan recommends the replacement of the existing downtown bus terminal with a new transit terminal adjacent to the proposed rail Whale's Tooth Station (see Figure 2.46). The replacement station is planned even if the rail station is not realized. Bike and pedestrian connections would be important considerations to connect riders to the station from downtown New Bedford and Route 6.

As detailed in the *South Coast Rail Corridor Plan Feeder Bus Plan* (2012), several bus routes would be rerouted to serve the proposed Whale's Tooth Station and relocated bus transit center. The altered bus routes, including SRTA routes 1, 2, 3, 4, 6, 8, 9, 10, and 11 would access the area from a proposed transit only bridge over Route 18 at Pearl Street. No new routes were proposed for Route 6 or the New Bedford-Fairhaven Bridge. If improvements were made to the bridge to increase reliability, SRTA Route 11 could potentially be realigned along its former route along the Route 6 corridor and once more cross the bridge.

Figure 2.46. Whale's Tooth Station Area Development



Source: South Coast Rail Corridor Plan, 2009

2.9 BICYCLE/PEDESTRIAN NETWORK

2.9.1 Existing Network

Currently, pedestrian conditions are not consistent and bicycle accommodations are limited along the Route 6 corridor within the Local Study Area. There is not a high demand for bicycle and pedestrian facilities along the corridor but the demand does exist. Data regarding pedestrian counts at each surveyed intersection is included in the Appendix. Due to the access limitations of the ramps over Route 18, Route 6 does not have a direct connection for pedestrians and bicyclists along the entire corridor. The following review of existing pedestrian and bicycle accommodations highlights the recent improvements and remaining issues along the Route 6 corridor. Specific accommodations are shown on Figure 2.47.

Figure 2.47. Route 6 Corridor Bicycle and Pedestrian Accommodations

MILL STREET/KEMPTON STREET

In New Bedford, westbound Route 6 (Mill Street) between Pleasant Street and County Street was recently reconstructed including new sidewalks. The project was completed in 2013 and upgraded the roadway to include new crosswalks, ADA ramps, walk signal indicators, and bicycle traffic indicators in each vehicular lane. The intersection of Kempton Street and County Street also has new ADA ramps, crosswalks, walk signal indicators, and bicycle signal indicators in each vehicular lane. The unsignalized intersection of Kempton Street and Hill Street lacks crosswalks, ADA ramps, or any pedestrian or bicycle signalization. With the exception of the north side of Kempton Street between Hill Street and Pleasant Street and a grassy median between Kempton Street and Foster Street that lack sidewalks, sidewalk conditions along Kempton Street are in fair to good condition.

KEMPTON STREET/ROUTE 6 AND PURCHASE STREET/PLEASANT STREET "OCTOPUS INTERSECTION"

The intersection of Pleasant Street, Kempton Street (eastbound Route 6), Mill Street, Sixth Street, and the ramps to the New Bedford-Fairhaven Bridge is a busy intersection just west of Route 18. The intersection provides access to the bridge from the west, to downtown New Bedford from the north and west, and to Route 18 and I-195 from the downtown. Although there are extensive pedestrian accommodations at the intersection, the majority are flawed and do not meet current ADA guidelines. Each approach has crosswalks and a pedestrian signal, with the exception of the Kempton Street approach.

SRPEDD completed the *Pleasant Street-Kempton Street-Mill Street-Sixth Street-Route 6 Intersection Study* (Octopus Intersection Study) for the "Octopus Intersection" in New Bedford in 2012. Three pedestrian crashes have occurred at this intersection in the past several years, with one fatality, due to numerous safety and congestion problems. A pedestrian bridge was located east of the intersection that connects over Route 6, but pedestrians were reluctant to use it due to its isolated location, steep grade, and concern for personal safety and has since been removed by the City of New Bedford.

The City of New Bedford is undertaking a $750,000 improvement project based on the results of the Octopus Intersection Study. The project is focused on pedestrian improvements and will add new walk signals, improved lighting, brick islands, and landscaping that will shorten the crosswalk length and slow down traffic. The construction is planned to occur in the spring and summer of 2015.

WEST BRIDGE APPROACH

The segment of Route 6 between the "Octopus Intersection" and MacArthur Drive has a bicycle and pedestrian prohibition that forces bicyclists and pedestrians to seek different routes to access the bridge. A new ramp that runs from northbound Route 18 (JFK Memorial Highway) near Union Street provides access over MacArthur Drive up to the southerly sidewalk along the bridge. The only access to the northerly sidewalk on the western end of the bridge is from a set of stairs that leads up from MacArthur Drive.

NEW BEDFORD-FAIRHAVEN BRIDGE

A sidewalk runs along the entire length of the northerly and southerly sides of the bridge between MacArthur Drive in New Bedford and Middle Street in Fairhaven. The bridge does not have a dedicated bike lane in either direction. During bridge construction events, at least one of the sidewalks along the bridge has been closed, causing pedestrians to detour to the other side of the street to cross the bridge. Locations for safe pedestrian crossings are extremely limited along the length of the bridge. A single crosswalk on Pope's Island is the only crosswalk between the shorelines. Pedestrians or bicyclists using the northerly sidewalk cannot cross Route 6 and access the ramp that connects the southerly sidewalk to Route 18/JFK Memorial Highway. Instead, they must use a set of stairs that leads down to MacArthur Drive.

MIDDLE STREET TO ADAMS STREET

MassDOT completed a project in 2013 to install new traffic signal systems and new ADA-compliant curb ramps at Middle Street, Main Street, Green Street, and Adams Street. The traffic signal systems were coordinated and included phasing to improve safety and congestion. Signage indicating the shared use of the vehicular lanes with bicyclists and "sharrows" are located on the outside vehicular traffic lanes for the entire segment. SRPEDD's 2006 *Route 6 Corridor Safety Study* had identified the 1.6-mile segment between Middle Street and Narragansett Boulevard in Fairhaven as experiencing a high percentage of traffic crashes.

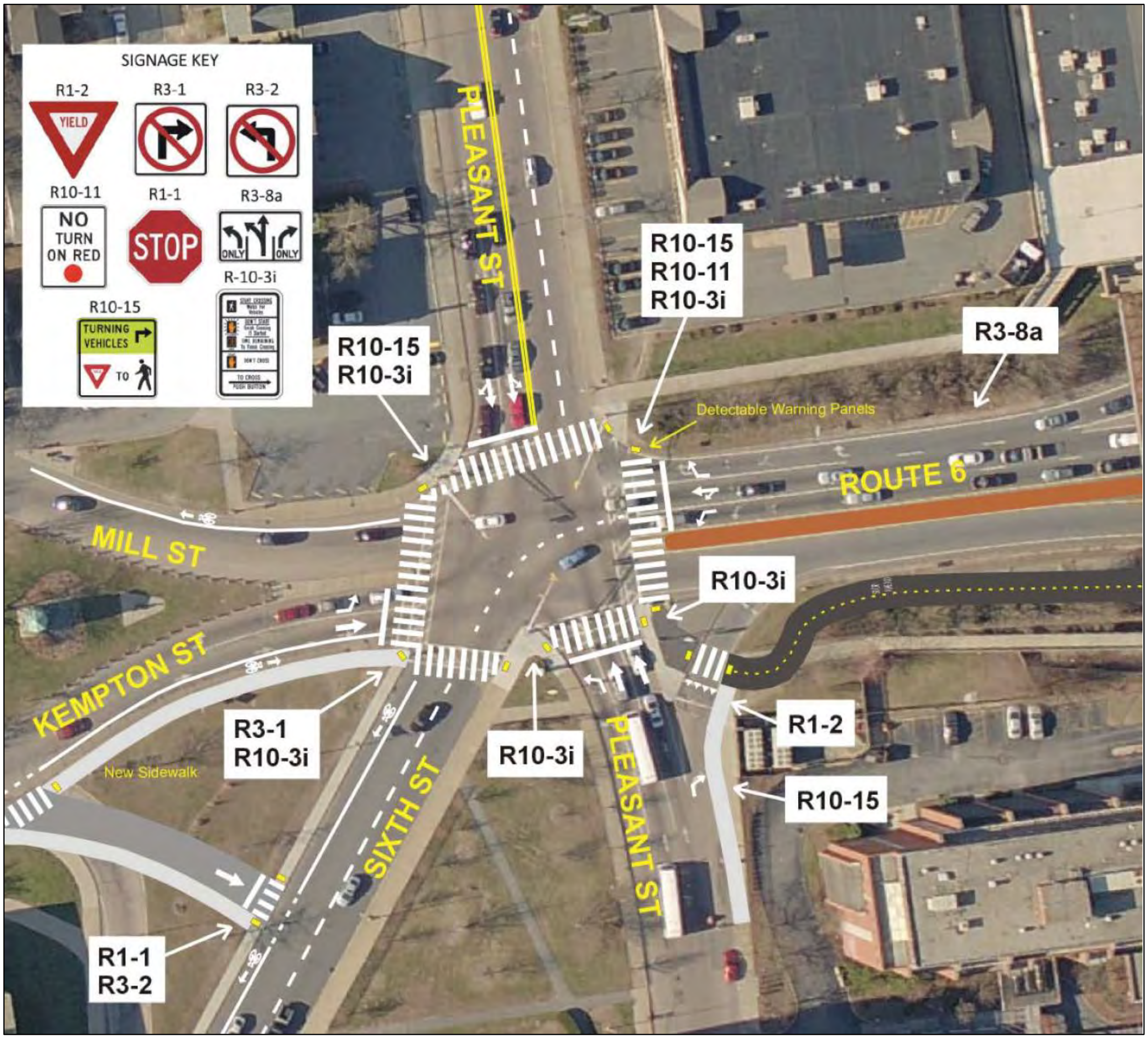
2.9.2 Planned Improvements

As shown in Figure 2.48, the Octopus Intersection Study concluded that upgrades to traffic signal equipment, pavement markings, signage, ADA compliant sidewalks, crosswalks, and formal bicycle lanes, and the pedestrian overpass are needed at this important intersection. The plan also recommended a multi-use path on the south side of Route 6 east of Pleasant Street that would connect to the JFK Memorial Highway Bike Path.

As a component of SRPEDD's *Southeastern Massachusetts Bicycle Plan* and the *2012 Regional Transportation Plan*, the South Coast Bikeway is a proposed 50-mile continuous system of bike or multi-use paths that would run from the Rhode Island-Massachusetts border to the Cape Cod Canal. As shown in Figure 2.49, several segments of the bikeway network have been completed, including the Phoenix Rail Trail in Fairhaven. As previously shown in Figure 2.47, this multi-use path ends at Main Street in Fairhaven. An on-road segment is proposed to run along Main Street in Fairhaven between Route 6 and the existing path. Another on-road segment is proposed along Route 6 to allow bicycles to cross the New Bedford-Fairhaven Bridge. A multi-use path aligned along Route 18/JFK Memorial Highway in New Bedford is proposed to provide connections to the north and south.

The bridge corridor is also included on the MassDOT's proposed Bay State Greenway on-road and off-road bicycle network initially proposed in 2008.

Figure 2.48. "Octopus Intersection" Recommended Improvements



Source: Pleasant Street-Kempton Street-Mill Street-Sixth Street-Route 6 Intersection Study, New Bedford

Figure 2.49. Proposed South Coast Bikeway

Source: SRPEDD/South Coast Bikeway

2.10 NO BUILD CONDITIONS ANALYSIS

An analysis of the conditions projected for 2035 with no substantial changes in the corridor was conducted. The analysis, called the No Build conditions analysis was completed to evaluate the need for corridor intersection improvements regardless of the decisions related to long-term bridge alternatives. As will be further detailed in Chapter 3 and 4, the long-term alternatives for the bridge have little impact on future corridor traffic conditions, therefore the more detailed no-build conditions analysis was conducted which separates any potential impacts from changes to the bridge with improvement needs within the corridor. The following section identifies the demands and conditions of travel projected to occur within the corridor in 2035.

2.10.1 Future Demand (Maritime Traffic Forecasts)

The biggest demand for vessel access north of the New Bedford-Fairhaven Bridge is created by the cargo and fishing industries. The demand for larger vessel access is currently driven by the commerce generated by Maritime Terminal, whose primary warehouse and cold storage facility is located above the bridge. The HDC is also looking at the potential development of additional facilities north of the bridge, including the potential for offshore wind turbine fabrication and development in the future.

MARITIME TERMINAL

Maritime Terminals is one of the primary importers of fruit and other agricultural products reaching the markets of New England and Canada. The company provides chilled and frozen product storage services as well as warehousing services. New Bedford is a primary intermodal connecting port for these products as well as other fisheries-based product. Port facilities including Maritime Terminals have good highway and rail access. Maritime Terminals will soon have its interchange restored and will be able to access rail equipment, capable of handling approximately three times the capacity of a single truck. Rail car weights are up to 263,000 pounds per car including the weight of the car. Truck weights average 80,000 pounds.

According to representatives from Maritime Terminals, the company currently handles about 10 to 12 ships per year at the terminal, but in past years handled as many as 25 ships. The highest number of vessels in recent history was 30 ships in a year. The company handled about 600 reefer containers in 2013 last year by rail and truck. Ships average around 2,000 to 2,600 pallets with larger vessels around 3,500 pallets.

The terminal once handled a significant amount of South American fruit including apples. These cargoes are now handled by competitive ports including Wilmington, Delaware and Philadelphia, Pennsylvania. Ship calls have dropped off since the 1990s, but are potentially on the rise with Maritime Terminals expecting 25 ships in 2015. Recapturing this cargo alone would add another 10 to 12 ship calls annually. The key factor is the amount of unencumbered deep water berthing available, which optimally would include the existing facility above the bridge, the State Pier and the new Marine Commerce Terminal. Competition in these market areas is considered significant and New Bedford is among a few remaining ports that have full service facilities that can handle these cargos, including the Delaware River facilities.

Maritime Terminals representatives reported a substantial concern about the New Bedford-Fairhaven Bridge. In 2013, three ships were delayed and could not transit the bridge due to wind restrictions. This adds substantial cost to a vessel's port call. These same restrictions do not exist for New Bedford's primary competitors.

COMMERCIAL FISHING INDUSTRY

The highest regular demand for bridge openings is created by the fishing industry. The port is home on a permanent or transient basis to over 360 fishing vessels engaged in ground fishing and other fishing activities, including the scallop industry. Many of the boats in New England have relocated to New Bedford because of its proximity to fishing grounds, regulatory constraints and high value harvesting of scallops. Berthing and other services have expanded in the port due to these relocations.

Fishing vessels require frequent openings of the bridge to accommodate their outriggers since when they are stowed, the masts and antennas exceed the available air draft height of the current bridge when closed. For the most part, any commercial vessel transiting north of the bridge will require a bridge opening because of the shallow air draft of the closed bridge. Overall, however, vessels time their transits to the scheduled bridge openings and are not adversely impacted unless the bridge cannot be opened.

There is a good amount of vessel berthing north of the bridge. An estimated 30 to 40 vessels berth at piers or nest in the upper harbor. There are also unloading and storage/processing facilities including American Seafoods International, Eastern Fisheries, and Marlees Seafood, located just north of Maritime Terminals. Processors report at least 10 to 12 vessels are berthed at any one time either unloading or moored at each facility.

Eastern Seafoods, for example, operates 25 of their own scallop vessels with 30 on site currently. The vessels range from 75 to 100 feet in length. They have three waterfront plant locations in New Bedford totaling 110,000 square foot of processing and cold storage space in the port, most of which is located above the bridge. This includes a 44,000 square foot facility and a 42,000 square foot facility. They also have approximately 500 feet of berthing with 25 to 30 feet alongside. The company also provides ice to the fishing fleets but a number of vessels prefer not to load ice above the bridge due to potential delays caused by the bridge schedule if they miss an opening. The company handles 20 million pounds of scallops annually as well as monkfish, dogfish and skate.

OTHER FACTORS FOR FUTURE PORT DEMAND

In addition to expansion of existing facilities, the Port of New Bedford has potential expansion from the development of new facilities at the waterfront properties in the North Harbor. Additional expansion could come from undefined sources that evolve from the opportunities related to access benefits of New Bedford related to regional highway and rail network connections to the major metropolitan markets of New York and Boston.

The Port of Boston is undertaking an expansion of their international container activity at Conley Terminal and addressing roadway constraints into the facility. This increase in cargo activity could result in potential constraints with road access for trucks calling on Conley Terminal. Shippers benefit from competitive transportation services. If the Port of New Bedford is able to develop alternative services to areas not served by Boston's ocean carriers, the Port may consider it logical for New Bedford to develop potential short sea services to New York or ocean cargo services into Mexico or South America.

The State is currently developing a *Ports of Massachusetts Strategic Plan* to evaluate the potential of the Port of New Bedford for maritime cargo. The State's Seaport Advisory Council is currently studying how to expand the focus on the state's ports. Significant to this is the development of the marine highway network that could open up realistic opportunities for the Port. Marine highway activities could include exported seafood product and transloading of heavy weight cargo from rail cars such as paper being shipped to Asia. The Seaport Advisory Council identified that to optimize these activities, expansion of cargo activities should take into account a maximum amount of deep-water berthing and associated facilities with cargo handling equipment. It should also include protection of the marine industrial zones along the New Bedford waterfront.

To accommodate future growth the EPA facility in the north harbor area would need to be redeveloped in order to make the North Terminal area capable of handling cargo shipments. This would entail construction of new bulkheads, pier areas with dredged berths, and an extension of the channel. Even with the identified improvements, the full functionality of the North Terminal area would be constrained unless the New Bedford-Fairhaven bridge were modified to eliminate or minimize navigational constraints.

The cargo potential for the North Harbor includes business related to containerized cargo, scrap steel, project cargos, and road salt. For example, containers destined to Southeastern Massachusetts are now trucked from New York, Boston and other port locations. This traffic could potentially come through a North Harbor facility instead. Additionally road salt was once handled by White Construction in New Bedford but is now transported from Rhode Island.

South of the bridge, the State Pier is currently the primary cargo facility in the port. It is used by Maritime Terminal to some extent for handling cargo. The facility is also used for berthing of fishing boats. Annual boat rates for the fishing fleet are $1,500 per year per boat. According to the HDC, in the future, the northern side of the State Pier may be appropriate for mixed-use development and the south side of the property could be used for tourism and cargo. The area might include moveable food areas or tables/chairs for picnics. These areas would be transformed and tourism based equipment removed when a cargo ship was docked. The property, however, is under the ownership and responsibility of the State. To make this vision possible, the State would need to give these facilities to the City of New Bedford.

If the Marine Commerce Terminal is not fully utilized as planned, even with the State Pier's and Maritime Terminal's berth, berthing capacity is below what is available at competitive ports. The bridge, if not modified or replaced to reduce or eliminate restrictions, would be a further limiting factor that would place the port at a competitive disadvantage.

VESSEL PROJECTIONS

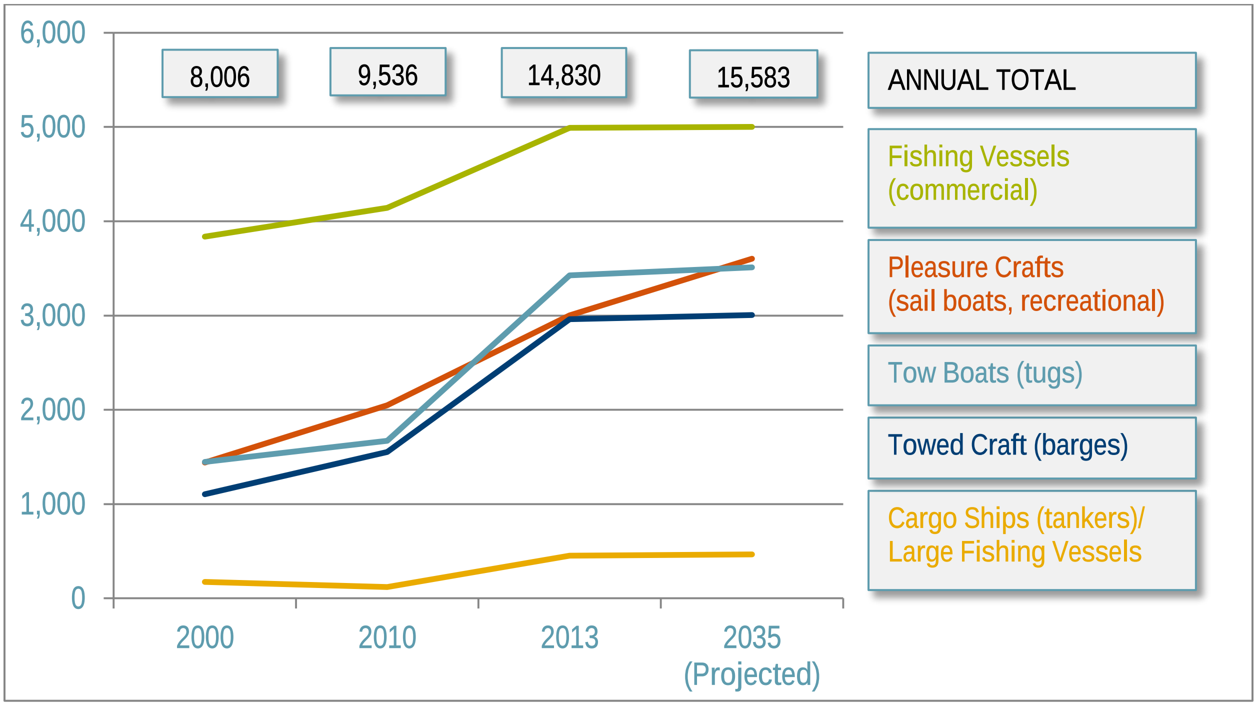
As previously discussed, the number of vessels that transit the bridge has increased in recent years. This increase is due in part to both ongoing port development and the EPA harbor cleanup. In the future, if the New Bedford-Fairhaven Bridge is not altered and the same physical limitations exist to vessels to transit through the bridge, it is anticipated that the growth will be minimal.

Using the MassDOT's Monthly Drawbridge Reports between 2000 and 2013, the number of annual bridge openings and the types of vessels that passed through the bridge were analyzed. Between 2000 and 2013, the total number of vessels increased by 85 percent, from 8,006 to 14,830. This growth is due to an increase in all types of vessels: commercial fishing vessels, pleasure crafts (i.e., sailboats or other recreational vessels), towboats, towed craft, and cargo ships or large commercial fishing vessels.

As shown in Figure 2.50, the growth of commercial fishing vessels and cargo ships is expected to increase only slightly between 2013 and 2035. The projected growth during this time is based on a five percent growth assumption, with is consistent with industry-wide growth projections.

This is a modest rate of growth, and would result in an increase from 14,830 vessels in 2013 to 15,583 vessels in 2035. Pleasure craft such as sailboats and other recreational vessels are anticipated to be the primary growth of vessels using the bridge. While the EPA harbor cleanup is expected to wind down in the upcoming years, the number of towboats and tugs is anticipated to stay at current levels to accommodate the growth of cargo and sand barges that will utilize new facilities north of the bridge.

Figure 2.50. Vessel Projections



Source; 2010-2013 MassDOT Monthly Drawbridge Reports

2.10.2 Future Conditions (Vehicular Traffic Forecasts)

The No Build conditions analysis included evaluating traffic conditions projected for the year 2035 within the Regional Study Area. The existing balanced traffic volumes collected in April 2014 were projected to the year 2035 and combined with the potential traffic generated due to planned developments in the study area. The resulting traffic volumes were analyzed to obtain baseline future traffic conditions that will be compared against the proposed alternative scenario conditions to determine the impacts due to each alternative.

BACKGROUND GROWTH RATE

In order to calculate the background growth rate, the TransCAD regional traffic forecasting model provided by SRPEDD was used. The forecast model is assumed to capture the effects of increases in housing, population, employment, and economic activity within the region, and is thus used as a representative measure for traffic growth. The 2035 projected traffic volumes along all major arterials and highways in the study area were compared with SRPEDD's baseline volumes to estimate an average traffic growth rate. A growth rate of 0.6 percent and 0.7 percent per year was estimated for the towns of New Bedford and Fairhaven, respectively. These growth rates were used to project 2014 balanced existing traffic volumes to 2035 background traffic volumes.

FUTURE DEVELOPMENTS

Based on an investigation of various proposed developments in the Local Study Area it was determined that the South Coast Rail project is expected to generate a considerable amount of traffic in the areas adjacent to the New Bedford-Fairhaven Bridge. A Final Environmental Impact Statement (FEIS) dated August 2013 published for this project was reviewed and the proposed additional traffic in the study area was estimated.

In addition, the City of New Bedford and the regional Economic Development Corporation (EDC) were consulted to investigate additional potential developments in the study area that could generate significant traffic. It was determined that a proposed hotel with approximately 150 rooms, on the corner of Elm Street and Water Street, in downtown New Bedford is expected to generate traffic. Potential trips generated due to this development were estimated using the Trip Generation Manual (9^{th} Edition) published by the Institute of Transportation Engineers (ITE).

2035 NO BUILD VOLUME DEVELOPMENT

In order to develop the projected 2035 No-Build roadway volumes, the traffic generated due to the South Coast Rail project and the proposed hotel were added to the 2035 background traffic to develop 2035 No Build traffic volumes. These trips were assigned to the study area roadway network based on traffic counts and previous knowledge of the study area. Detailed No Build traffic volumes for the major intersections in the Regional Study Area are shown in Appendix E.

2035 NO BUILD CAPACITY ANALYSIS

The No Build traffic volumes were used to conduct a detailed capacity analysis of the intersections within the Regional Study Area. This was done to gain an understanding of future traffic conditions along the Route 6 corridor and existing and potential detour routes.

Synchro was used and the HCM-based methodology was applied to determine performance metrics such as volume-to-capacity ratio, delay, and LOS of the study intersections. As noted in Section 2.7.3, an acceptable mid-LOS D is defined as 45 seconds of delay for signalized intersections and 30 seconds of delay for non-signalized intersections.

During the AM peak hour, 12 of the 36 intersections are projected to operate with overall intersection average vehicle delay values above the acceptable delay threshold. An additional eight intersections will have one or more lane groups that exceed the acceptable delay threshold. Thus 20 of the 36 intersections will have an approach or the entire intersection operating at a delay that exceeds the threshold in the AM peak hour. This is an increase of five intersections over the existing condition that exceed the acceptable threshold.

The intersections with deteriorated AM peak hour conditions include:

- Kempton Street and Cottage Street;
- Huttleston Avenue and Adams Street;
- Coggeshall Street and Ashley Boulevard;
- Coggeshall Street and Belleville Avenue; and
- Howland Road and Alden Road.

During the PM peak hour, 15 of the 36 intersections will operate with overall intersection average vehicle delay values above the delay threshold. An additional six intersections will have one or more lane groups that exceed the delay threshold. Thus a total 21 of the 36 intersections will have an approach or the entire intersection operating at a delay that exceeds the HCM threshold in the PM peak hour. This is an increase of four intersections over the existing condition that exceed the acceptable threshold. . The intersections with deteriorated PM peak hour conditions include:

- Mill Street and County Street;
- Huttleston Avenue and Bridge Street;
- Coggeshall Street and Acushnet Avenue; and
- Coggeshall Street and Belleville Avenue.

A graphical representation of the LOS at all study intersections is shown on Figure 2.51. Detailed delay and LOS tables are provided in Appendix F.

CAPACITY ISSUES

In order to highlight capacity issues and constraints in the study area, intersections have been divided into the following three categories:

- Route 6 corridor;
- Intersections along MassDOT's current detour route; and
- Intersections along potential future detour routes within the Regional Study Area.

Route 6 Corridor
The Route 6 corridor consists of Route 6 from County Street in New Bedford to Adams Street in Fairhaven. Seven intersections were analyzed along this corridor for detailed capacity constraints. A summary of intersection delays and LOS for 2035 No-Build conditions are provided in Table 2.25 below:

Figure 2.51. Regional Study Area Intersection LOS, 2035 No Build Conditions

Table 2.25. Comparison of Route 6 Corridor Intersection Delay and LOS Summary, 2014 Existing and 2035 No Build Conditions

ID#	Intersection Name	2014 AM Int. Delay	2014 AM Int. LOS	2014 PM Int. Delay	2014 PM Int. LOS	2035 AM Int. Delay	2035 AM Int. LOS	2035 PM Int. Delay	2035 PM Int. LOS
1	Mill Street and County Street	20.6	C	23.3	C	22.6	C	49.6	D
2	Kempton Street and County Street	15.4	B	14.6	B	17.5	B	17.5	B
3	Kempton Street/Mill Street and Purchase Street ("Octopus Intersection")	73.5	E	80.7	F	87.7	F	112.5	F
4	Huttleston Avenue and Middle Street	9	A	10.3	B	9.8	A	11.6	B
5	Huttleston Avenue and Main Street	25	C	26.8	C	26.3	C	28.6	C
6	Huttleston Avenue and Green Street	12.1	B	10.4	B	13.2	B	11.4	B
7	Huttleston Avenue and Adams Street	26	C	16.7	B	39.1	D	18.1	B

An intersection with a LOS E or worse and a volume-to-capacity ratio of one or more approaches equal to or greater than 1.0 is considered to be at or over capacity. As noted in the above table, all the intersections along the Route 6 corridor will operate at acceptable LOS with an exception of one intersection that is highlighted in red. The primary issues along the Route 6 corridor occur at the "Octopus Intersection" due to capacity constraints. The other issue is the additional capacity required on northbound and southbound Adams Street.

- **Kempton Street/Mill Street and Purchase Street.** The intersection of Kempton Street/Mill Street and Purchase Street ("Octopus Intersection") will deteriorate from LOS E under existing conditions to LOS F under No-Build conditions during the AM peak hour. Though it will remain at LOS F during the PM peak hour, an increase in delay will be experienced. Currently, there is considerably high left-turn traffic demand on the eastbound and westbound approaches under current conditions, and as noted in Section 2.7.2 and based on observations made during April 2014 counts, this left-turn traffic demand is only expected to increase. By 2035, this intersection is expected to have an increase in eastbound left-turn traffic during long-term bridge closures along with an overall increase in traffic. This highlights the need to address future capacity issues through additional lanes and signal timing adjustment. This intersection currently operates on a pre-timed split signal phasing. The approaches have approximately equal traffic demand.
- **Huttleston Avenue and Adams Street.** The intersection of Huttleston Avenue and Adams Street will deteriorate from LOS D under existing conditions to LOS E and F under future conditions during the AM peak and PM peak hours, respectively. During both peak hours, the northbound approach will operate at LOS F.

Intersections Along Current MassDOT Detour Route
MassDOT closed the New Bedford-Fairhaven Bridge to vehicular traffic for necessary structural repairs in April 2014. The following detour plan was posted for the drivers by MassDOT.

- **Route 6 westbound traffic.** Travel north along Main Street, left onto Howland Road until Coggeshall Street, and left onto Route 18 southbound.
- **Route 6 eastbound traffic**. Travel along Route 18 northbound onto I-195 eastbound at Exit 15 to Exit 18 and onto Route 240 southbound.

Ten key intersections along the current detour path were analyzed as part of the existing and 2035 No-Build conditions analysis. The delays and LOS associated with each of these intersections under the 2035 No Build conditions for AM and PM peak hours are provided in Table 2.26. In addition, the detour route and the intersections impacted due to the current detour route are shown in Figure 2.52.

Table 2.26. Comparison of Delay and LOS Summary of Intersections along current MassDOT Detour Route, 2014 and 2035 No Build Conditions

ID #	Intersection Name	2014 AM Int. Delay	2014 AM Int. LOS	2014 PM Int. Delay	2014 PM Int. LOS	2035 AM Int. Delay	2035 AM Int. LOS	2035 PM Int. Delay	2035 PM Int. LOS
1	Huttleston Avenue & Route 240	20.7	C	20	C	22.1	C	21.9	C
2	Bridge Street & Route 240	114.8	F	51.4	D	157.6	F	78.6	E
3	Hillman Street & Purchase Street	11.2	B	12.8	B	12.2	B	15.4	B
4	Hillman Street & JFK Memorial Hwy NB on-ramp	-	-	-	-	-	-	-	-
5	Coggeshall Street & Ashley Boulevard	21.9	C	48.9	D	34.4	C	102.0	F
6	Coggeshall Street & Acushnet Avenue	18.1	B	19.6	B	20.5	C	35.2	D
8	Coggeshall Street & N Front Street	7.2	A	58.2	F	19.0	C	180.1	F
9	Coggeshall Street & Belleville Avenue	27.6	C	28.9	C	49.5	D	56.9	E
10	Coggeshall Street & I-195 off-ramp	56.6	E	64.3	E	79.0	E	97.1	F
11	Howland Road & Main Street	50.8	D	124.7	F	93.3	F	225.6	F

Out of the ten intersections analyzed, the intersections that operate at LOS E or F during either AM and/or PM peak hours under No Build conditions are highlighted in red in Table 2.26.

- **Bridge Street and Route 240.** During AM peak hour, the intersection of Bridge Street and Route 240 will experience an increase in delay while operating at LOS F under both existing and No-Build conditions. During PM peak hour, the LOS changes from D under the existing condition to E under the No-Build condition. In 2035, a LOS F will be experienced on all approaches except westbound approach during AM peak hour and southbound approach during PM peak hour. This intersection experiences high traffic demand due to its location along Route 240.

- **Coggeshall Street and Ashley Boulevard.** During the PM peak hour, the intersection of Coggeshall Street and Ashley Boulevard is expected to change from a LOS D in the existing conditions to LOS F in a No-Build condition.
- **Coggeshall Street and N. Front Street.** The intersection of Coggeshall Street and N. Front Street is a stop-controlled intersection. Under PM peak hour conditions the intersection is currently operating at a LOS F, but an increase in delay from existing to No-Build conditions is anticipated.
- **Coggeshall Street and Belleville Avenue.** During the PM peak hour, the intersection of Coggeshall Street and Belleville Avenue will change from a LOS C in existing condition to LOS E in No Build conditions.
- **Coggeshall Street and I-195 off-ramp.** During AM peak hour, the intersection of Coggeshall Street and the I-195 off-ramp is anticipated to experience increase in delay from the existing to No Build conditions. Whereas during PM peak hour, the intersection changes from LOS E in existing to LOS F in the No-Build condition. The westbound and southbound approaches during both peak hours and northbound I-195 off-ramp approach during PM peak hour exceed capacity and operate at LOS F. This intersection will need additional capacity under high right-of-way constraints to accommodate 2035 traffic conditions.
- **Howland Road and Main Street.** During the AM peak hour, the intersection of Howland Road and Main Street will change from LOS D in the existing condition to LOS F in the No Build condition. While the intersection currently operates at LOS F, the intersection will experience increase in delay during the PM peak hour. All approaches except westbound approach of this intersection have currently reached or exceeded capacity.

As noted above, three out of six intersections along the current detour route are expected to exceed capacities in the No Build condition. They are currently experiencing high delays on almost all the approaches and will likely require additional capacity in terms of additional lanes. While the remaining intersections are currently operating adequately, they could be improved by adjusting signal timing phasing, splits, or offsets. Considering the capacity constraints, the diversion of traffic to these intersections needs to be reviewed and placement of additional ITS signs to divert traffic to other streets should be considered.

Intersections Along Potential Future Detour Routes

In addition to the intersections listed above, nineteen other key intersections within the regional study area were analyzed for capacity issues and constraints. In the event of a long-term bridge closure, these intersections are expected to experience changes in traffic patterns. The knowledge of operations of these intersections in future conditions will support the task of reviewing the placement of current ITS signs and propose new signs. The delay and LOS associated with these intersections are summarized in Table 2.27.

Figure 2.52. Current Detour Routes

Table 2.27. **Comparison of Delay and LOS Summary of Intersections along Potential Future Detour Routes, 2014 Existing and 2035 No Build Conditions**

ID #	Intersection Name	2014 AM Int. Delay	2014 AM Int. LOS	2014 PM Int. Delay	2014 PM Int. LOS	2035 AM Int. Delay	2035 AM Int. LOS	2035 PM Int. Delay	2035 PM Int. LOS
1	Kempton Street and Brownell Avenue/Route 140	54.9	D	63.9	E	84.3	F	93.6	F
2	Kempton Street and Cornell Street	11	B	9	A	13.5	B	10.6	B
3	Kempton Street and Rockdale Avenue	53.8	D	56.8	E	80.5	F	76.2	E
4	Mill Street and Rockdale Avenue	16.8	B	16.8	B	19.0	B	21.4	C
5	Mill Street and Cottage Street	17.6	B	16.5	B	19.2	B	17.0	B
6	Kempton Street and Cottage Street	20.8	C	14.4	B	34.7	C	14.0	B
7	Huttleston Avenue and Holcomb Street	7	A	7.1	A	7.7	A	8.0	A
8	Huttleston Avenue and Bridge Street	15.1	B	17.8	B	17.4	B	27.8	C
9	Huttleston Avenue and Alden Road	28.36	C	39.8	D	31.6	C	62.1	E
10	Bridge Street and Alden Road	44	D	51.8	D	60.2	E	77.1	E
11	Union Street and Route18	2.3	A	2.4	A	2.8	A	2.9	A
12	Purchase Street and JFK Memorial Highway SB off-ramp	25.9	D	18.8	C	65.6	F	48.0	E
13	Linden Street and County Street	10.8	B	14.3	B	12.1	B	18.2	C
14	Washburn Street and Belleville Avenue	26.3	D	107.3	F	63.4	F	1941.6	F
15	Coggeshall Street and Mt. Pleasant	11.7	B	12.2	B	13.4	B	14.6	B
16	Coggeshall Street and County Street	12.2	B	13.1	B	12.9	B	14.4	B
17	Coggeshall Street and Purchase Street	170	F	14.7	B	261.5	F	20.7	C
18	Howland Road and Adams Street	41.4	D	39	D	52.3	D	50.0	D
19	Howland Road and Alden Road	4.2	A	5.6	A	6.1	A	24.0	C

As highlighted in red in Table 2.27, seven of the nineteen intersections in this sub category will operate at either LOS E or F during AM and/or PM peak hours under No-Build conditions.

- **Kempton Street and Brownell Ave/Route 140.** The intersection of Kempton Street and Brownell Avenue/Route 140 will change from LOS D to LOS F during AM peak hour and will change from LOS E to LOS F during the PM peak hour. All approaches except westbound approach will operate at LOS F during the No Build condition. Heavy left turn and through movement volumes on the eastbound and southbound approaches cause equal demand for signal split time. The southbound and northbound approaches operate at split phases thus increasing the demand for signal split times. This intersection potentially needs additional lane capacity.

- **Kempton Street and Rockdale Avenue.** The intersection of Kempton Street and Rockdale Avenue will change from LOS D in the existing condition to LOS F in the No Build condition during AM peak hour. The intersection will remain at LOS E in the No Build condition, but will have increased delays during PM peak hour. It currently experiences significantly high northbound left turn volumes, especially during the AM peak hour, which results in long queues on the northbound approach. The southbound approach has considerably high volumes as well; however, it does not receive adequate split time due to the advanced lead phase on the northbound left-turn. There is a need for additional turning lanes in the northbound direction with potential right-of-way constraints. This intersection has high truck turn volumes as well, causing other potential issues such as inadequate turning radii and safety concerns.
- **Huttleston Avenue and Alden Road.** During the PM peak hour, the intersection of Huttleston Avenue and Alden Road will change from LOS D in the existing condition to LOS E in the No Build condition. The Route 6 eastbound and westbound approaches experience high demand.
- **Bridge Street and Alden Road.** The intersection of Bridge Street and Alden Road will change from LOS D in the existing condition to LOS E in the No Build condition, during both AM and PM peak hours. The southbound approach will operate at LOS F during the AM peak hour and the eastbound and northbound approaches will operate at LOS F during the PM peak hour, whereas the remaining two approaches operate at LOS E. This intersection potentially needs additional lane capacity in combination with signal timing adjustment to address LOS issues.
- **Purchase Street and JFK Memorial Highway.** The intersection of Purchase Street and JFK Memorial Highway southbound off-ramp will change from LOS D to LOS F during the AM peak hour and from LOS C to LOS E during the PM peak hour. This is a result of high left turn demand on the westbound approach operating under stop control. Though there is high demand on the westbound approach there is relatively less conflicting traffic on the northbound and southbound Purchase Street approaches. Field observations or gap study should be considered to estimate whether sufficient gaps would be available for the side street turning traffic.
- **Washburn Street and Belleville Avenue.** The intersection of Washburn Street and Belleville Avenue will change from LOS D to LOS F during AM peak hour and will remain at LOS F during PM peak hour, though with a higher delay. This intersection is primarily used by traffic entering and exiting eastbound I-195. The I-195 ramps are located approximately 300 feet east of this intersection along Washburn Street. The majority of I-195 exiting traffic makes right turn at the westbound approach of the intersection, which is under stop control. However, this movement is not in conflict with any major movements at the intersection. The other major movements include southbound left-turn movement and eastbound through movement, which are conflicting traffic. Traffic on eastbound approach is stop controlled and, as noted during field visits, has sufficient gap time to maneuver through the intersection

without excessive delay. Consequently, this intersection is expected to experience less delay than projected in the HCM based analysis.

- **Coggeshall Street and Purchase Street.** The intersection of Coggeshall Street and Purchase Street will experience an increase in delay while operating at LOS F under AM conditions. The traffic demand is not excessive at this intersection.

The short- and medium-term alternatives to be discussed in subsequent chapters will be developed with an objective of addressing the issues and constraints discussed above. These alternatives upon implementation are expected to accommodate the long-term replacement or closure of the bridge under forecasted 2035 traffic demand conditions.

2.11 SUMMARY OF ISSUES

2.11.1 Vehicular Traffic

CURRENT

The minimum time to open and close the bridge is 7.5 minutes. The typical time to open and close the bridge is actually 12.5 to 22.5 minutes, depending on vehicular, pedestrian, and marine traffic clearance times. Due to the variable traffic delays and bridge maintenance projects that have occurred numerous times over the last 30 years, vehicular traffic on the bridge has declined. Motorists have found other routes to avoid the growing number of delays caused by the bridge openings and construction.

Located about one mile north of the New Bedford-Fairhaven Bridge, Coggeshall Street/Howland Road and I-195 provide alternatives to local and regional traffic. When the bridge closes for construction or when it opens for marine traffic, traffic detours onto these roadways adding to the existing capacity issues. Several intersections within the Regional Study Area, including the alternate route along Coggeshall Street/Howland Road currently operate with overall intersection average vehicle delay values above the acceptable delay threshold. The LOS of several intersections, including the "Octopus Intersection," currently operate at a LOS E or F, which are below the acceptable threshold.

The New Bedford-Fairhaven Bridge closes to vehicular approximately once an hour between 6AM and 7PM. The average delay time is approximately 12.5 minutes. During the hourly bridge closures, traffic queues form on either side of the movable bridge. Based on recent observations that coincided with lane reductions on the bridge, the eastbound queue typically extends 1,600 feet onto the Route 18 southbound off-ramp during the AM peak period. The westbound queue extends 1,300 feet to the Dunkin Donuts driveway on Pope's Island in the AM. It is typically even longer, almost 2,350 feet to the Fairhaven shoreline, during the PM peak period.

ITS signs are utilized in both New Bedford and Fairhaven to inform drivers when the bridge is closed to vehicular traffic. Traffic count data reveals that a decrease in traffic on the bridge approaches occurred when the signs were illuminated indicating that the bridge is closed. This decrease in traffic indicates that drivers are utilizing alternate routes during bridge closure. However, lengthy traffic queues continue to occur on both sides of the bridge.

FUTURE

In the future No-Build Condition, the overall intersection average vehicle delay values at key intersections within the Regional Study Area, including several along the Route 6 corridor and the Coggeshall Street/Howland Road detour route will continue to experience delays above the acceptable threshold. At several intersections, delays will increase and LOS will decline. Three out of the six corridor intersections are expected to exceed capacities in No-Build conditions and experience high delays on almost all approaches. The LOS at two corridor intersections and several intersections along Coggeshall Street/Howland Road will deteriorate and increased delay times will occur.

The two intersections along the Route 6 Corridor with existing delay times above the acceptable delay threshold will experience a further increase in delay times. The "Octopus Intersection" is expected to experience an increase in delays by 15 and 30 seconds, with a LOS of F in both the AM and PM peak travel periods. The Huttleston Avenue and Adams Street intersection is expected to see an increase in delays of 30 to 70 seconds, with a LOS of E in the AM and LOS of F in the PM peak travel periods. Intersections along the bridge detour route are also expected to experience increases in delay time and declining LOS.

2.11.2 Marine Traffic

CURRENT

The current bridge has a vertical clearance of only six feet. Due to the limited vertical clearance, the majority of vessels, including recreational vessels, require the bridge to open to pass through the bridge. Over the last 30 years, the number of bridge openings has increased 200 percent. Each day, the bridge is scheduled to open 13 times, equaling 4,380 scheduled openings per year. In 2013, the bridge opened 5,524 times.

The number of vessels per year has increased over the last 30 years, from just 2,403 in 1981 to 14,830 vessels in 2013. The number of larger vessels has also increased. Between 1981 and 2013, the number of cargo ships or large fishing vessels increased almost 600 percent, from 81 to 452 vessels.

The width of the New Bedford-Fairhaven Bridge's opening is another constraint to vessels. The swing span navigational width is 92 feet, compared to the 150-foot wide hurricane barrier that limits vessel size at the entrance to the harbor. To navigate through the bridge, larger vessels require additional pilotage and tug fees to deal with other navigational constraints. Some larger vessels are unable to navigate the bridge.

The shipping channel also presents limitations to vessel depth and speed. While the federal shipping channel is 30 feet deep, under keel clearance requirements results in an effective transit draft of 26 feet for vessels. New Bedford Harbor requires a slow speed transit. The speed limit in the harbor is 5 mph.

FUTURE

In the future even without changes to the configuration of the bridge, the number of vessels per year is expected to continue to increase. Between 2013 and 2035, the number of vessels is projected to increase by five percent. Correspondingly, the number of bridge openings is also projected to increase by four percent. The number of large vessels, including cargo ships (tankers) and large fishing vessels, tow boats, and barges are expected to increase only modestly, by approximately two to three percent. The number of pleasure crafts including sailboats and motor boats that pass through the bridge are anticipated to increase by 20 percent. Significant changes to bridge configuration is anticipated to result in changes to the make-up of the future marine traffic. By eliminating the constraint, the number of large cargo vessels to serve New Bedford could increase. Although these vessels represent a small percentage of marine traffic, they could result in substantial benefits to the regional economy.

2.11.3 Multi-Modal Access

The New Bedford-Fairhaven Bridge is the only pedestrian or bicycle access point between downtown Fairhaven and New Bedford. The bridge has a sidewalk on either side of the travel lanes, but there is only one crosswalk between the New Bedford and Fairhaven shores. Pedestrian access to the bridge from New Bedford is limited to a sidewalk constructed as part of a new ramp from northbound JFK Memorial Highway. A staircase on the north side of Route 6 connects down to MacArthur Drive. Pedestrians and bicyclists are prohibited on the Route 6 ramps between Purchase Street and MacArthur Drive. The primary concern along the bridge is the lack of crosswalks. A single crosswalk on Pope's Island provides a safe crossing point for pedestrians between the New Bedford and Fairhaven shorelines.

The pedestrian facilities in the remainder of the corridor were examined and in most of the corridor the facilities were in fair to good condition. Some limited areas lack sidewalks, including the north side of Kempton Street between Hill Street and Pleasant Street and a grassy median between Kempton Street and Foster Street.

Currently, there are no safe routes for bicyclists on the bridge. Many bicyclists use the sidewalks to cross the bridge, which creates additional safety concerns for pedestrians. At the western end of the bridge, bicyclists cannot cross from the north side of the bridge to the pedestrian/bicycle ramp that leads from the south side of the bridge down to JFK Memorial Highway. A staircase is the only way off the bridge on the north side.

2.11.4 Safety

As discussed in Section 2.7.4, the most common types of crashes in the Local Study Area are angle crashes, rear-end crashes, and single-vehicle crashes.

Most of the rear-end crashes occur along the New Bedford-Fairhaven Bridge in slow moving traffic. This is potentially due to the stop-and-go conditions as part of long queues. In addition, a majority of the single vehicle crashes occurred on the New Bedford-Fairhaven Bridge. These crashes involved vehicles colliding with physical objects such as trees, guiderails, medians, curbs, bridge overhead structures, or other movable objects. A review of accident data indicates that the addition of construction related activities in the corridor accounts for a high percentage of the crashes.

2.11.5 Transit

In July 2013, the SRTA Route #11 was altered to avoid the bridge and use Coggeshall Street bridge instead. A major reason for the route modification was the inconsistent travel times that occurred due to bridge openings. The alternative route between New Bedford and Fairhaven proved more reliable for scheduled service between the two communities. Although the modified service is longer, it can serve more people along the route.

2.11.6 Environmental

Within the Local Study Area, there are numerous environmental considerations, including floodplains, wetlands, and other natural resources. The New Bedford Harbor has existing PCB contamination and an ongoing EPA cleanup to remediate the issues. Some of the EPA cleanup CAD disposal sites are located in the north harbor area, just north of Pope's Island.

The study area also includes historic resources, including the New Bedford National Register Historic District. The middle bridge has been deemed eligible for listing on the National Register.

2.11.7 Community Effects

Within the Local Study Area, demographic data indicates a high percentage of minority, low-income, or limited-English proficiency populations. The concentration of these populations indicates that the entire Local Study Area is within an area of EJ populations. This raises the potential for concern if the negative project impacts are significant since the study area's EJ population percentage is higher than the regional percentage. Community outreach efforts are important to ensure that project impacts do not discriminate based on race, color or national origin, age, disability and sex, among other protected categories.

Several parks and open spaces are located within the Local Study Area. This includes the City of New Bedford's Marine Park located on Pope's Island. Changes to the existing roadway could affect access to this city-owned park and marina.

The middle bridge was previously deemed eligible for listing on the National Register of Historic Places. Due to its eligibility, the bridge will be subject to the requirements of Section 106 of the National Historic Preservation Act (NHPA). A previous determination by the Massachusetts Historical Commission in 1980 indicated that since there were no feasible or prudent alternatives to avoid demolition, replacement of the bridge could progress following proper documentation of the structure. As the current bridge project develops, the FHWA will need to enter into consultation with the MHC to address any effects to historic properties, including any impacts on the adjacent historic districts.

2.11.8 Economic Development/Land Use

The channel width of the New Bedford-Fairhaven Bridge limits the development potential of the port north of the bridge. Several properties are available for redevelopment and there is potential to expand existing maritime uses within the Designated Port Area.

Increasing the bridge opening could increase the attractiveness of the Port of New Bedford as a destination for large cargo vessels. Other improvements to the bridge could result in increased port economic development potential. The port could not only accept an increased number of commercial fishing vessels, but could also be able to accept new types of cargo from vessels that are currently too large to transit through the New Bedford-Fairhaven Bridge into the north harbor.

Unemployment is high in New Bedford (9.5 percent compared to 6.0 percent in Massachusetts or 6.3 percent in the U.S.) The port is not only an important employer, it is also a valuable economic engine for the city, region, and state. Due to the strong scallop market, the catch value is increasing and the port has been the most valuable in the U.S. for the last 10 years. Each vessel has an estimated $100,000-$150,000 direct impact on the local economy. The port provides 4,400 existing jobs. The future expansion potential at the port is critical for job growth and local and regional economic development.

The physical constraints of the bridge have resulted in delays to cargo shipments. If winds are greater than 10 knots, vessels cannot transit the bridge due to the width. Vessels can be delayed for a day or more, with each day of delay costing on average $40,000.

The New Bedford-Fairhaven Bridge provides the sole access to Fish Island and Pope's Island. Continued and future development on these islands is closely tied to potential bridge improvements. The elevation of the existing roadway and bridge could directly affect access to the majority of the properties on these two islands.

2.12 SUMMARY OF OPPORTUNITIES

In development of long-term Alternatives, the following opportunities will be evaluated for incorporation into the concept designs and configuration of potential improvements

2.12.1 Marine Traffic

The Port of New Bedford has extensive refrigeration and processing/handling facilities available to support both the fishing industry and cargo shipments, with 4.5 million cubic feet of cold storage and excellent distribution and warehousing facilities. As noted in the 2010

Massachusetts Freight Plan The harbor is host to an already substantial seafood processing industry, with 25 wholesale and 35 processing operations, and is poised to continue to grow. By improving port access through bridge improvements, the demand for seafood processing operations will undoubtedly increase; the Port of New Bedford has the expertise, equipment, and available space to accommodate continued growth in this highly important complementary industry. Increasing the port's ability to accept incoming fish creates a direct local economic impact by increasing demand for employment in the processing industry.

The port has a Foreign Trade Zone (FTZ), which is particularly important for sustaining freight operations and provides an incentive for future growth. Goods in the FTZ can be assembled, manufactured, or processed, and final products re-exported, without paying Customs duties. The Port of New Bedford also notes that commercial use of the port is also exempt from the Harbor Maintenance Tax, a federal tax imposed on shippers based on the value of imported goods being shipped through a particular port. These factors provide the port with a considerable competitive advantage, offering a potential cost advantage for foreign businesses considering trade in U.S. markets.

The Port once handled a significant amount of South American fruit. These cargos are now handled by competitive ports including Wilmington, Delaware and Philadelphia, Pennsylvania. Ship calls have dropped off since the 1990s, but are potentially on the rise with Maritime Terminals expecting 25 ships in 2015. Recapturing this cargo alone would add another 10 to 12 ship calls annually from past years. The key factor to this growth is the amount of unencumbered deep water berthing available, which optimally would include the North Harbor area, the State Pier and the new Marine Commerce Terminal. Competition in these market areas is considered significant and New Bedford is among a few remaining ports that have full service facilities that can handle these cargos, including the Delaware River facilities.

2.12.2 Multi-Modal Access

Key components of the North Harbor, are the direct highway connections to I-195 and Route 6 and the New Bedford Rail Yard. Connecting to the north and into the national railroad network, the 33.5-acre rail facility has 12 acres available for rail car staging and can accommodate 100 rail cars in its present configuration. These critical intermodal connections, along with a large amount of industrial land and potential for expanded berthing, provide the port with a viable and realistic seaport development zone. This includes further development of deep water berthing constrained only potentially by the existing bridge. Currently, the New Bedford-Fairhaven Bridge limits the size of vessels that can enter the north harbor area and limits the expansion potential of existing maritime uses within the Designated Port Area north of the bridge.

The Port of New Bedford benefits from great access to a diverse and growing transportation network. Trucking rates are significantly lower in New Bedford as compared to other major regional ports like Boston, New York, and Philadelphia. According to the Port of New Bedford, the port offers a shorter distance to many end-destinations, provides access to New England, the greater Northeast, and southern Canada markets, and offers an alternative that avoids major bottlenecking intersections along the I-95 Corridor.

New Bedford already has the infrastructure setup to expand its cargo operations. The harbor itself is well protected from surges by its hurricane barrier. The port enjoys unencumbered deep-water access. Extensive navigational dredging has recently taken place in the harbor, improving water quality and allowing the port to continue to accept larger vessels that cannot be accommodated by most other ports in New England.

2.12.3 Transit

The South Coast Rail project is the proposed restoration of commuter rail service between Boston's South Station, Fall River, and New Bedford. The proposed route would extend the commuter rail service from the route's current terminus in Stoughton and would terminate at a new station in New Bedford located within the Local Study Area.

As described in the 2009 South Coast Rail Economic Development and Land Use Corridor Plan, the proposed Whale's Tooth Station, which is located near the Route 6 corridor, and would restore passenger commuter rail to the City of New Bedford and maximize on the economic and environmental benefits of rail investment to the city and the region.

2.12.4 Economic Development/Land Use

Significant area for redevelopment exists within the entire Port of New Bedford. Within the North Harbor area, improving the bridge could encourage business development throughout the entire harbor.

The *New Bedford/Fairhaven Municipal Harbor Plan* is the state-approved plan for New Bedford Harbor. The plan includes the Designated Port Area (DPA) master plan and outlines the ongoing dredging process established through the State Enhanced Remedy (SER) and the location of the Confined Aquatic Disposal (CAD) sites in the harbor.

A portion of the 65 acre New Bedford DPA extends into the Local Study Area. Along with 10 other DPAs in Massachusetts, state policy seeks to "preserve and enhance the capacity of the DPAs to accommodate water-dependent industrial uses and prevent significant impairment by non-industrial or non-water-dependent types of development, which have a far greater range of siting options."

Additionally the Hicks-Logan-Sawyer neighborhood located adjacent to the North Harbor and within the Local Study Area is prime for redevelopment. The City of New Bedford developed the *Hicks-Logan-Sawyer Master Plan that* guides the development for this important mixed-use waterfront neighborhood.

The 10-acre North Terminal, an area with redevelopment potential, is located in the study area and currently has a range of existing uses. The North Terminal Area could accommodate a freight laydown and open storage area. Part of the area is owned by the City of New Bedford and the HDC has plans to rehabilitate and add five additional acres of usable land. Plans include dredging and fill, addition of a new pier, and adding rail spurs allowing for additional vessel/rail connections.

The entire New Bedford portion of the Local Study Area falls within a Priority Development Area, including the waterfront, the area around the proposed Whale's Tooth Station, and downtown New Bedford. A Priority Development Area is a zone established through the South Coast Rail Corridor Plan that have the greatest capacity or potential to accommodate and support new development such as major downtowns, employment centers, and future station areas. The plan designated 30 different Priority Development Areas within the overall region.

2.13 SUMMARY OF CONSTRAINTS

In development of long-term Alternatives, the following constraints will be incorporated into the concept designs and configuration of potential improvements

2.13.1 Marine Traffic

In the closed position, the bridge creates an impediment to most marine traffic. Any improvement should minimize the closure time during the construction phase. Prolonged closures will not be acceptable, as it would eliminate marine access to all businesses in the North Harbor.

2.13.2 Horizontal Clearance

A potential replacement bridge will need to accommodate between 125 and 150 feet of horizontal clearance. The two existing marine channels are 94 and 95 feet on either side of the central pier. The hurricane barrier offers a 150-foot wide horizontal clearance for vessels into the New Bedford Harbor. An increase in channel width at the bridge to match the width of the hurricane barrier would remove shipping constraints for vessels into the North Harbor.

2.13.3 Vertical Under-clearance (Air Draft)

Any replacement bridge needs to provide sufficient vertical under-clearance, or air draft, for vessels into the North Harbor. The tallest vessels that currently transit the bridge require at least 100-125 feet of air draft. Currently, emergency vessels cannot transit the existing bridge in the closed position and must wait for the bridge to open. The majority of the existing emergency vessels require 14 feet of vertical clearance.

2.13.4 Roadway Profile

While the elevation of the bridge to increase vertical under-clearance in the closed position would benefit unimpeded marine vessel transit and reduce the vehicular traffic delays, an increased roadway profile could affect pedestrian and bicycle access across the bridge. The maximum grade should be five percent, but a less steep grade would be preferred to facilitate bicycle and pedestrian access across the bridge. Additionally, the five percent grade should not extend for more than 800 feet as the grade then becomes difficult for bicycle and pedestrian travel.

2.13.5 Roadway Traffic

The New Bedford-Fairhaven Bridge currently operates with one lane in each direction due to construction activity and experiences long queues during peak hours. As discussed in Section 2.7.5, the queues extend to Route 18 on- or off-ramps on the west and few feet short of the Middle Street intersection on the east. During the No-Build conditions, the queue lengths along the New Bedford-Fairhaven Bridge are expected to increase due to an increase in traffic caused by background growth and additional developments in the area.

2.13.6 Community Impacts

The existing bridge provides the only way to access the properties and businesses located on Fish Island and Pope's Island. Any future bridge or roadway improvements should maintain access to adjacent parcels and businesses along both Fish Island and Pope's Island.

2.13.7 Environmental Conditions

Any improvements should consider the existing PCB contamination in the New Bedford Harbor. Improvements that require significant in-water work is also likely to disturb contaminated soils within the harbor and require significant environmental mitigation activities.

3 Alternatives Development

The development of alternatives was guided by the identification of the issues, constraints, and opportunities within the study corridor, along with the goals and objectives identified in the early stages of the study. As identified in Chapter 1, the purpose of this study was to evaluate multimodal transportation and associated land use issues, develop potential solutions, and to recommend improvements along the Route 6 Corridor between County Street in the City of New Bedford and Adams Street in the Town of Fairhaven.

During the alternative development process, the study team identified a set of feasible alternatives for short-, medium-, and long-term improvements in the corridor. The long-term alternatives focus on options and impacts of the potential replacement of the New Bedford-Fairhaven Bridge. The study team also identified a number of short- and medium- term improvements related to the corridor multi-modal transportation system. These nearer term improvements are related to intersection improvements for vehicles, pedestrian and bicycle accommodations, and bridge and traffic information systems.

This chapter describes in detail the screening process used to develop the alternatives and a description of the potential improvements. Chapter 4 provides in-depth analyses and evaluation of the alternatives.

3.1 LONG-TERM ALTERNATIVES SCREENING PROCESS

The long-term alternatives considered as part of this study focus on improving the functionality and addressing the impacts caused by the New Bedford-Fairhaven Bridge itself. A number of past bridge studies completed over the last 30 years were reviewed and conclusions from those studies are presented, along with a review of the key bridge alternative attributes. These key attributes that were used to identify the long-term alternatives include corridor alignment, bridge vertical clearance, marine channel horizontal clearance, and potential bridge or crossing types.

This section provides the rationale for the identification and screening of the preliminary long-term alternatives. This rationale is based on a review of conclusions from previous bridge studies, physical limitations of the bridge approach and clearance issues, and an assessment of the 2014 Existing Condition and the 2035 No Build Condition. The primary focus of these past studies was to eliminate or minimize the impact of the bridge on development opportunities in the North Harbor. This focus remains a driving force in identifying and developing long-term alternatives as part of this study. The long-term alternatives were based on four different physical attributes that were identified as part of this screening process:

- Roadway corridor and alignment;
- Vertical underclearance;
- Marine channel horizontal clearance; and
- Potential bridge/crossing types.

These attributes were used to identify the preliminary long-term alternatives described later in this chapter.

3.1.1 Review of Previous Studies & Conclusions

As described in Chapter 2, the New Bedford-Fairhaven Bridge is a major transportation constraint along the Route 6 Corridor. Modification of this bridge in the future could help minimize or eliminate some of these constraints to both vessels transiting the bridge and roadway users crossing over the bridge.

Several previous studies, including the *Feasibility Study Report* (1969), *Corridor Planning Study Report* (1977), *Environmental Assessment* (1985), and *Conceptual Alternative Study for the Relocation of the Route 6 Bridge over New Bedford Harbor* (2004), explored various corridors, crossing or bridge types, bridge configurations, clearances, and other options related to potential replacement of the New Bedford-Fairhaven Bridge. Much of the analyses conducted for these studies remains valid and therefore has been reviewed and incorporated into the development of alternatives for this study.

In identifying attributes of preferred bridge alternatives, most of the studies had similar conclusions. Many concluded that the continued use of the existing corridor and alignment were preferred over a new crossing location. Most of the studies also determined that the benefits of a higher bridge did not offset the impacts of the lengthened roadway approaches and therefore identified that a vertical profile similar to the existing bridge was preferred. A thorough assessment of bridge/crossing types was also conducted as part of past studies. A movable bridge type was typically preferred because a fixed bridge that would not constrain marine traffic would have to be very high, more than likely resulting in significant impacts.

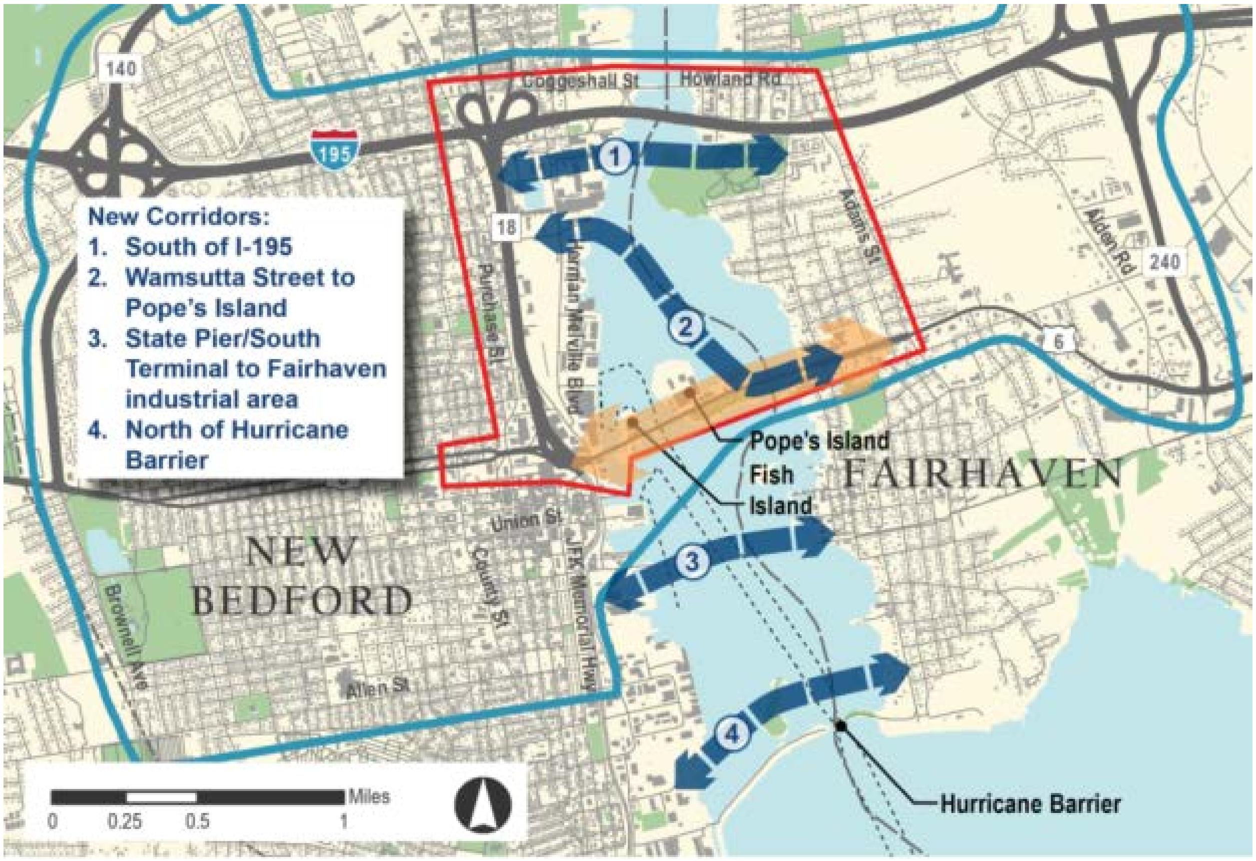
Based on two decades of extensive study, the preferred alternative from the 1985 EA was a double-leaf bascule bridge with a 10-foot vertical underclearance using the existing alignment. This decision was re-evaluated in the 2004 study, which recommended the relocation of the bridge along a northern corridor spanning between Wamsutta Street and Pope's Island. Major impacts regarding alignment of access routes near Wamsutta Street were identified, but were not resolved as part of the 2004 study's recommendation.

3.1.2 Roadway Corridor & Alignment

The past corridor studies analyzed the existing crossing and four possible locations for a new crossing between New Bedford and Fairhaven. As shown in Figure 3.1, four potential new bridge crossing corridors were evaluated:

- Just south of the I-195;
- Wamsutta Street to Pope's Island;
- State Pier/South Terminal to Fairhaven industrial area; and
- Just north of hurricane barrier.

Figure 3.1 Potential New Bridge Corridor Alignments



As part of the long-term alternative development process for this study, the four new corridors proposed in previous studies were determined to be unsatisfactory. The primary reasons for this conclusion are presented in Table 3.1.

Past studies concluded that the existing corridor was the most advantageous because it provides the shortest and most direct route between the historic business centers in Fairhaven and New Bedford, requires the minimum width of crossing over the harbor, and creates no additional obstructions to navigational traffic.

The study team also concluded that retaining the existing roadway horizontal alignment along the existing corridor is also preferred for several reasons. Most notably, bridge replacement along the existing alignment would eliminate the need for significant land acquisition and related business displacements on Fish Island or Pope's Island. The major disadvantage of bridge replacement on the existing alignment would be the disruption to bridge roadway traffic during construction.

Table 3.1 Summary of Potential New Bridge Corridor Alignments

Corridor Alignment Option	Issues/Constraints/Advantages/Disadvantages
1. New corridor south of I-195	• Close proximity to the I-195 bridge. • Provides a less direct route between the main business centers in New Bedford and Fairhaven. • Requires new roadway connections on both sides of the harbor. • Depending on the type of bridge constructed, would require excessively long elevated or underground structures as part of the bridge approaches.
2. New corridor between Wamsutta Street and Pope's Island.	• Interferes with an existing dredged maneuvering area in North Harbor. • Interferes with the future development of the north terminal. • Requires new roadway connections on both sides of the harbor. • Depending on the type of bridge constructed, would require excessively long elevated or underground structures as part of the bridge approaches. • A replacement bridge in this corridor was considered in the 2004 study. The principal issues associated with this proposal that were unresolved as part of the 2004 study were the required new interchange with Route 18 and the creation of entirely new traffic patterns in New Bedford.
3. New corridor between State Pier/South Terminal and Fairhaven industrial area.	• Requires elimination of large amounts of existing dock space. • Creates a new obstruction to existing navigational traffic in South Harbor. • Requires new roadway connections on both sides of the harbor. • Depending on the type of bridge constructed, would require excessively long elevated or underground structures as part of the bridge approaches.
4. New corridor just north of hurricane barrier.	• Provides a less direct route between the main business centers in New Bedford and Fairhaven. • Requires a long roadway connection to Route 6 and new roadway connections on both sides of the harbor. • Depending on the type of bridge constructed, would require excessively long elevated or underground structures as part of the bridge approaches. • Creates a new obstruction to existing navigational traffic in South Harbor. • Requires an excessively long crossing.

3.1.3 Vertical Underclearance

The vertical underclearance is an important consideration given the increasing number of bridge openings that result from the inability of most vessels to pass under the low clearance of the existing bridge. The current New Bedford-Fairhaven Bridge has an underclearance of six feet when in the closed position, which results in frequent openings for almost all vessels that need to transit the bridge.

Earlier studies reviewed multiple bridge vertical underclearance options and concluded that a bridge with a higher underclearance of 50 feet or less would not provide substantive benefits over the existing vertical alignment. A 50-foot vertical underclearance would still require the bridge to open frequently. Additionally, it was identified that substantially increasing the underclearance of the bridge over 35 feet would result in significant impacts to the roadway network and adjacent properties, which were considered unacceptable. The alternatives assessed as part of these earlier studies considered a range of increased bridge underclearances, including 20 feet, 23 feet, 35 feet, 42 to 72 feet, 50 feet, 60 feet, and 135 feet.

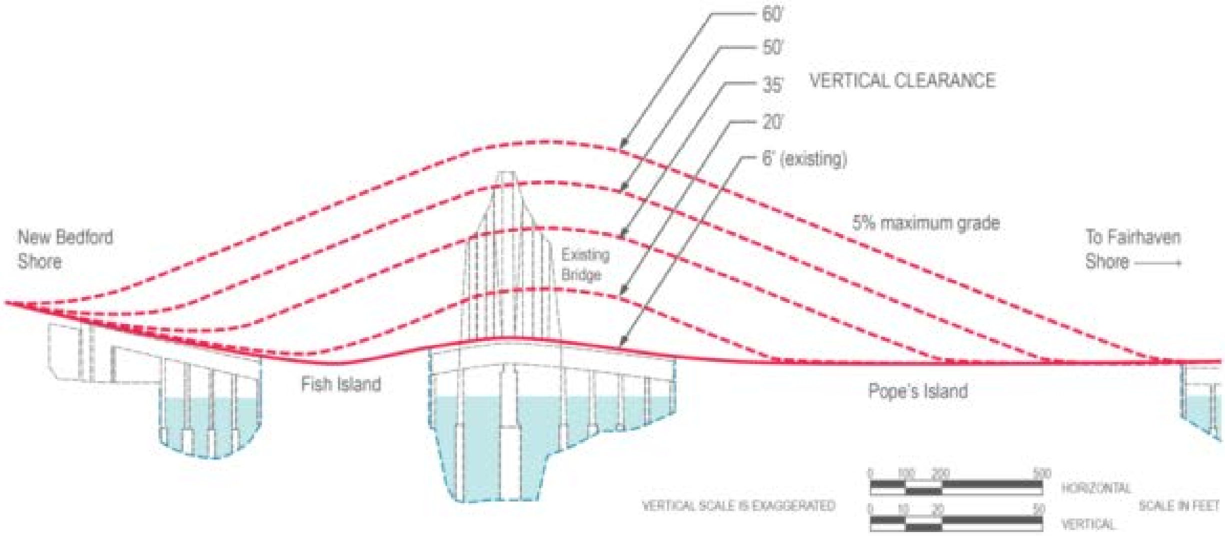
The impacts of increased bridge vertical underclearance vary greatly depending on the specific height. Any increase from the existing six-foot underclearance would necessitate the use of increased grades on the highway surface to clear the navigational channel. Additionally, as the vertical underclearance increases, the length of the bridge approaches would also need to increase so that the roadway remains in conformance with accessibility and highway safety standards. If the bridge underclearance was increased to over 50 feet, access to Fish Island and Pope's Island would be eliminated to accommodate the required approaches. An additional bridge structure would have to be constructed to each of the islands at or near the existing elevation, or ramps from the higher bridge structure would have to be constructed.

As discussed in the 1985 EA, replacement bridges with a higher vertical underclearance would result in a number of impacts. To maintain standard grades on the bridge approaches, the following types of impacts would result from a sample of potential higher underclearances:

- **20-foot underclearance**. This is the maximum underclearance that can be achieved without eliminating direct roadway access to Fish Island and Pope's Island. The middle (swing) bridge would have to be replaced and the west bridge would have to be reconstructed. The east bridge would not require any changes.
- **35-foot underclearance.** At this underclearance, Fish Island would be totally bypassed and another bridge would be required to provide access. The east end of Pope's Island would be maintained, but a new access roadway to parcels on the western edge would need to be provided. The middle bridge would have to be replaced and the west bridge would have to be reconstructed. The east bridge would not require any changes.
- **50-foot underclearance.** Fish Island and most of Pope's Island would be bypassed at this vertical clearance. A new form of access to Fish Island and most of the parcels on Pope's Island would be required. The middle bridge and the west bridge would be replaced. The east bridge would not require any changes.
- **60-foot underclearance.** All three bridges would have to be replaced with a single new bridge at this underclearance and both Fish Island and Pope's Island would be completely bypassed. A new form of access would have to be provided to each island, which could require an increase in the horizontal alignment of the roadway and result in greater impacts to adjacent properties.

Figure 3.2 provides a visual illustration of the impacts created by these four potential underclearance heights, specifically the length of approaches.

Figure 3.2 Bridge Vertical Underclearance Options



As shown in Table 3.2, the existing six-foot underclearance requires an opening for nearly every vessel that transits under the bridge. Increases in vertical underclearance could potentially reduce the number of unscheduled openings, as well as the length of time required for each opening. However, a review of the vessels that typically transit under the bridge indicates that a clearance of 35 feet or less would still require the bridge to open for 85 to 90 percent of the vessels. Furthermore, those vessels that would be able to fit under the bridge (i.e., recreational motorboats) with a 20-35 foot vertical underclearance typically transit the bridge during hours of scheduled openings, therefore having minimal impact on the number of bridge openings.

The ability for emergency vessels, including the City of New Bedford and Town of Fairhaven fire, police, and harbormaster vessels, to transit the bridge when it is open for vehicular traffic is an important consideration. Currently, all of these vessels are docked south of the bridge. This includes New Bedford's two fireboats, one police boat, and one harbormaster boat, which are located at the State Pier in New Bedford. Fairhaven's emergency vessels dock in the marina on Pope's Island. Four of these vessels generally need no more that 14 feet in air draft, while the largest fireboat requires 25 feet in air draft. Currently, all of these boats must wait for the existing bridge to open to marine traffic before they can access the north harbor. This potential delay in response time creates a safety concern.

The preferred alternative in the 1985 EA had a 10-foot vertical underclearance. This minimal increase over the existing 6-foot clearance allowed the bridge structure to be above the wash from wind driven waves during flood condition.

Based on the profile of existing and future projected vessels transiting the bridge, there does not appear to be any benefit to significantly increasing the vertical underclearance. By keeping the vertical profile of the bridge relatively flat, conditions will be preferable for non-motorized bridge users. Increasing access for the emergency vessels that transit the bridge and ensuring that these vessels can transit the bridge at all times is a significant consideration. For these reasons, the long-term alternatives will be developed with the vertical underclearance that is approximately 14 feet. Specific dimensions will be addressed based on detailed design.

Table 3.2. 2035 Projected Vessels and Openings by Vertical Underclearance Options

Vessel Type	Air Draft (feet)	2035 Projected Vessels Requiring Opening	2035 Projected Number of Openings	6-Foot Clearance % of Vessels Requiring Opening	6-Foot Clearance Number of Openings	20-Foot Clearance % of Vessels Requiring Opening	20-Foot Clearance Number of Openings	50-Foot Clearance % of Vessels Requiring Opening	50-Foot Clearance Number of Openings
Cargo Ships (tankers) / Large Fishing Vessels	-	465	172	100%	172	100%	172	100%	172
Fishing Vessels (commercial)	-	5,001	1,850	-	-	-	-	-	-
Scallop (55%)	60	2,751	1,018	100%	1,018	100%	1,018	100%	1,018
Troller (30%)	70	1,500	555	100%	555	100%	555	100%	555
Seiner (15%)	70	750	278	100%	278	100%	278	100%	278
Pleasure Craft	-	3,602	1,333	-	-	-	-	-	-
Recreational motor boats (60%)	5	2,161	800	100%	800	0%	-	0%	-
Sailboat (40%)	100	1,441	533	100%	533	100%	533	100%	533
Tow Boat (tugs)	12	3,511	1,299	100%	1,299	100%	1,299	60%	779
Towed Craft (barges)	40	3,004	1,112	100%	1,112	100%	1,112	35%	389
TOTAL	-	15,583	5,766	-	5,766	-	4,966	-	3,724
Reduction in Openings	-	-	-	-	-	-	(800)	-	(2,042)
% Reduction in Openings	-	-	-	-	0%	-	-14%	-	-35%

3.1.4 Horizontal Clearance

The two existing marine channels on either side of the central pier are 94 and 95 feet wide, while the channel through the hurricane barrier at the entrance to New Bedford Harbor is 150 feet wide. Previous studies recommended a replacement bridge that could accommodate a 150-foot-wide channel width. An increase in channel width to match the width of the hurricane barrier would remove the shipping constraints to the area north of the bridge.

In assessing the horizontal clearance requirements, it is first necessary to understand the types of vessels that may desire to transit the bridge in the future. The overall size of vessels that could transit the bridge is generally limited to channel and berthing limitations within the North harbor. A vessel with a 600-foot length overall (LOA) is considered the largest vessel that would come to the North Harbor. A vessel of this length would average less than 70 feet in beam (width).

The general standard for channel width is approximately three times the width of the largest anticipated vessel. New Bedford Harbor is already considered to have a constrained channel area due to the width of the hurricane barrier and therefore that general standard does not apply. Overall, the harbor pilots have stated their preference is for a bridge opening width set at the same width as the hurricane barrier.

In addition to the pilots' considerations, increasing the horizontal clearance to at least 150 feet is recommended for several reasons. A larger channel width at the bridge would reduce constraints to the North Harbor as compared to the rest of the harbor. Safety would be improved by allowing tugs to position themselves alongside larger vessels as they transit the bridge and by permitting the installation of an advanced fendering system that does not encroach on the channel width.

3.1.5 Potential Crossing/Bridge Types

The past bridge corridor studies also evaluated a number of bridge or crossing types. A summary of the bridge or crossing types is provided in Table 3.3. This table also highlights the issues, constraints, advantages, and disadvantages of each type. The bridge or crossing types reviewed included: a tunnel, permanent removal of a bridge, a fixed bridge with varying clearances, a bascule bridge, a vertical lift bridge, and a swing bridge. Several bascule bridge types were considered, including a traditional type with a counterweight underneath the roadway surface and a rolling or Dutch style that has the counterweight above the roadway surface. Both a single-leaf with one movable span and a double-leaf with two movable spans were reviewed for all bascule types.

Several of the bridge or crossing types previously considered have a number of issues or disadvantages that would make them unsuitable for consideration as part of this study. Consequently, these bridge types were rejected either because they would eliminate access for either maritime or vehicular/pedestrian/bicycle traffic, would be extremely costly or disruptive to the surrounding area, or would result in the loss of direct access to Fish Island or Pope's Island. For these reasons, a tunnel and a fixed bridge (low-level or high-level) were rejected from consideration. Complete removal of the bridge was also rejected.

The movable bridge types, including bascule bridges, vertical lift bridges, or swing bridges like the existing bridge, have the potential to achieve an acceptable balance for both vehicular and maritime traffic demands. The specific advantages or disadvantages of each of these types are outlined in Table 3.3.

Table 3.3 Summary of Bridge/Crossing Types

Bridge/ Crossing Type	Issues/Constraints/ Disadvantages	Advantages/Benefits
1. Tunnel	• Extremely costly. • Disruptive to surrounding area due to tunneling approaches. • Requires complete redesign of intersections and approaches. • Loss of direct access to Fish Island and Pope's Island. • Significant environmental impact due to disruption of harbor/PCB contamination.	• Eliminates need for periodic openings for maritime traffic. • Removes vehicular delays due to bridge openings.
2. Bridge Removal	• Loss of direct local connection between Fairhaven and New Bedford.	• Preferred option for maritime traffic as it removes the principal impediment to vessels.
3. Fixed Bridge		
3a. High-Level (over 80 feet clearance)	• Disruptive to the surrounding area due to the height of the bridge and the ramping required to connect to the adjacent roadway network. • Requires complete redesign of intersections and approaches. • Loss of direct access to Fish Island and Pope's Island or requires construction of new access to islands.	• Allows vehicular traffic and most maritime traffic to pass without conflict.
3b. Medium-Level (20-80 feet clearance)	• Creates barrier to north harbor to most commercial fishing vessels and all cargo ships. • Loss of direct access to Fish Island or requires construction of new access.	• Allows vehicular traffic to pass without conflict.
3c. Low-Level (10-20 foot clearance)	• Creates barrier to north harbor to all commercial fishing vessels and cargo ships.	• Allows vehicular traffic to pass without conflict. • Minimal impact on existing development on Fish Island and Pope's Island.

Bridge/ Crossing Type	Issues/Constraints/ Disadvantages	Advantages/Benefits
4. Bascule Bridge	• Medium- and high-level types will result in a loss of direct access to Fish Island and Pope's Island; disruptive to surrounding area; requires complete redesign of intersections and approaches; and could reduce number of openings required if clearance over 50 feet is provided.	• Permits the continued movement of both vehicular and maritime traffic through or over the bridge. • Unlimited vertical clearance when bridge is open to vessels. • Low-level types will not greatly reduce the number of bridge openings, but will have minimal impact on existing development on Fish Island and Pope's Island.
4a. Single-Leaf Bascule (Standard)	• Limits maximum channel width to 125 feet. • Requires piers and in-water construction, which increases potential for environmental impacts. • Significant construction impacts, requires bridge closure for vehicular traffic for 18-24 months.	
4b. Double-Leaf Bascule	• Requires piers and in-water construction, which increases potential for environmental impacts. • Significant construction impacts, requires bridge closure for vehicular traffic for 18-24 months. • Most expensive movable bridge type.	• Allows for channel width of 150 feet or greater.
4c. Alternative Bascule Bridge Types – Dutch Style or Rolling Style	• Design typically looks "industrial" due to sight of counterbalance. • Few examples of recent double-leaf Dutch or rolling bridges with horizontal clearances greater than 150 feet. • Long-term reliability concerns.	• Closure period could be reduced from standard bascule if bridge support shafts could be built out of the way of existing swing bridge and roadway. • Potential for minimal environmental impacts in harbor because less in-water work is required. • Allows for channel width of 150 feet with a single-leaf bridge. Wider channel widths can be accommodated with double-leaf bridge types. • Lower cost than standard bascule bridge types.

Bridge/ Crossing Type	Issues/Constraints/ Disadvantages	Advantages/Benefits
5. Vertical-Lift Bridge	• Limited vertical clearance when bridge is open to vessels (100-125 foot air draft clearance for vessels). • Requires high towers, which could create potential visual impacts. • Low-level types will not greatly reduce the number of bridge openings.	• Allows for a wider horizontal clearance (up to 300-foot span). • Off-site construction, short closure period required for installation (weeks, not months). • Potential for minimal environmental impacts in harbor because less in-water work is required. • Minimal access impacts on existing development on Fish Island and Pope's Island.
6. Swing Bridge	• Central pier creates obstruction in center of channel. The pivot pier would have to be relocated to create an unsymmetrical (Bobtail) swing that would allow 150-foot horizontal clearance on at least one of the channels. • Low-level types will not greatly reduce the number of bridge openings. • Construction period impacts would constrain marine traffic. • Reconstruction of central pier may have environmental impacts in harbor.	• Minimal impact to islands and surrounding land uses.
6b. Continued Maintenance of Existing Bridge (No Build)	• Age of structure, ongoing maintenance will continue to become more frequent and costs will continue to rise. • Does not increase channel width. • Does not reduce number of openings. • Does not encourage redevelopment of North Harbor.	

Based on the attributes of the various bridge/crossing types described above and the goals of the study, the following bridge types were recommended for further evaluation as part of the alternative development phase of the study.

1. **Double-Leaf Bascule Bridge (Standard).** This bridge type allows for a wider horizontal clearance and unlimited vertical clearances for vessels. It has the least visual impacts of all bridge types. However, due to the extensive in-water construction to accommodate the counterweight underneath the roadway surface, this bridge type is the most expensive, creates significant construction environmental impacts, and requires a lengthy bridge closure for vehicular traffic (18-24 months).

2. **Alternative Bascule Bridge: Dutch or Rolling Style.** The alternative bascule bridge types also allow for a wider horizontal clearance and unlimited vertical clearances for vessels. These two types of bascule bridges have counterweights located above the roadway surface, which results in less in-water work, fewer environmental impacts, a shorter construction period, and bridge closure for vehicular traffic. However, the visual impacts may be greater due to the counterweight's location above the roadway.
3. **Vertical Lift Bridge.** This type of bridge has a shorter construction period and has less construction environmental impacts. When the bridge opens to marine traffic, the vertical clearance for vessels is constrained by the height of the elevated roadway, which typically between 100 to 125 feet above the surface of the water. The towers used to lift the roadway surface can also create visual impacts due to their height.
4. **Continued Maintenance of Existing Bridge.** The 2035 No Build Condition of continued maintenance of the existing bridge should also be evaluated. However, the ongoing maintenance of the bridge is expected to become more frequent and more costly as the nearly 120-year old bridge continues to age. The continued use of the existing bridge would offer no changes to the channel width restrictions or reduction of bridge openings. Additionally, the redevelopment of the North Harbor Area may be affected due to vessel access restrictions.

3.2 DESCRIPTION OF LONG-TERM ALTERNATIVES

The study team developed a set of preliminary long-term alternatives based on the analysis and screening detailed in the previous section. The alternatives were refined during the alternative development process using a stakeholder advisory group and public input. Eight different long-term alternatives were developed:

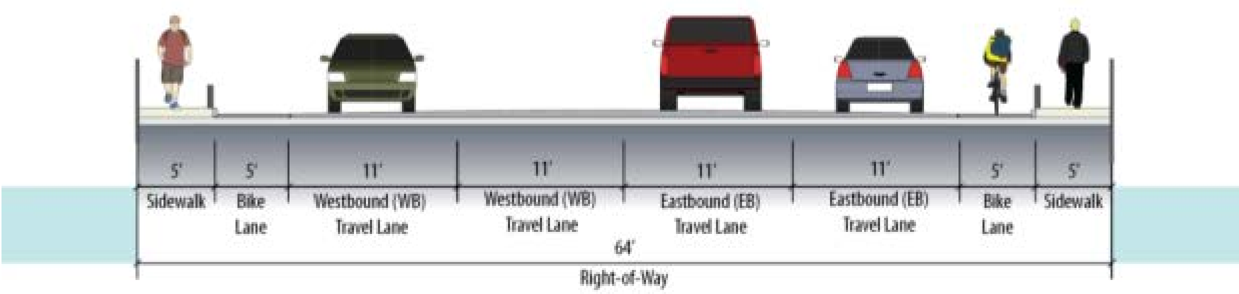
- **Alternative 1: Vertical Lift Bridge (110-135 feet vertical clearance)**
- **Alternative 1T: Tall Vertical Lift Bridge (150 feet vertical clearance)**
- **Alternative 2: Double-leaf Bascule Bridge (Standard)**
- **Alternative 2W: Wide Double-leaf Bascule Bridge (Standard)**
- **Alternative 3: Single-leaf Rolling Bascule Bridge**
- **Alternative 3W: Double-leaf Rolling Bascule Bridge**
- **Alternative 3D: Double-leaf Dutch-Style Bascule Bridge**
- **No Build Alternative: Repair Existing Swing Bridge**

Several of these long-term alternatives are similar, but have slight differences regarding physical dimensions. For example, the two vertical lift alternatives have different vertical clearance heights when the bridge is open for vessels. The two double-leaf bascule bridge alternatives have different horizontal clearance widths.

For the most part however, the study team developed the alternatives to have many consistent bridge attributes. The bridge attribute conclusions outlined in the previous section revealed that some attributes, such as underclearance and corridor alignment, should be consistent for all build alternatives. The consistent attributes for all alternatives include:

1. **Bridge Opening Time.** The time that it takes the bridge to open and close will not substantially change from the 2014 Existing Condition with any of the bridge alternatives. As discussed in Chapter 2, the duration of each bridge opening is dominated by the time it takes for vessels to pass through. This will not change with the configuration of the bridge. The time it takes for the actual bridge structure to open may be slightly improved with new mechanical systems. Since those changes would be measured in seconds and not minutes they would likely be immeasurable to most bridge users.
2. **Number of Bridge Openings.** The number of bridge openings is governed by the timing and frequency established for the scheduled openings, and the demand for openings during hours outside of the scheduled openings. As previously noted, over 80 percent of vessels passing through the bridge are over 20 feet high. Because each of the new bridge alternatives provides 14 feet of underclearance and the no build alternative retains the existing six-foot underclearance, the number of bridge openings is not projected to vary between alternatives or change significantly from the existing conditions.
3. **Corridor/Alignment.** The alignment of each of the new bridge alternatives will remain the same as the existing alignment. As identified earlier, all considered alternative alignments were identified to result in significantly more impacts. The existing bridge approaches will be utilized for all alternatives.
4. **Bridge Right-of-Way Width.** All of the new bridge alternatives would allow for a wider bridge. The right-of-way (ROW) width of the new bridge would be 64 feet wide. This would allow the accommodation of four eleven-foot-wide vehicular traffic lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. The cross section for all of the build alternatives is shown in Figure 3.5.

Figure 3.3 New Bridge Alternatives Cross-Section



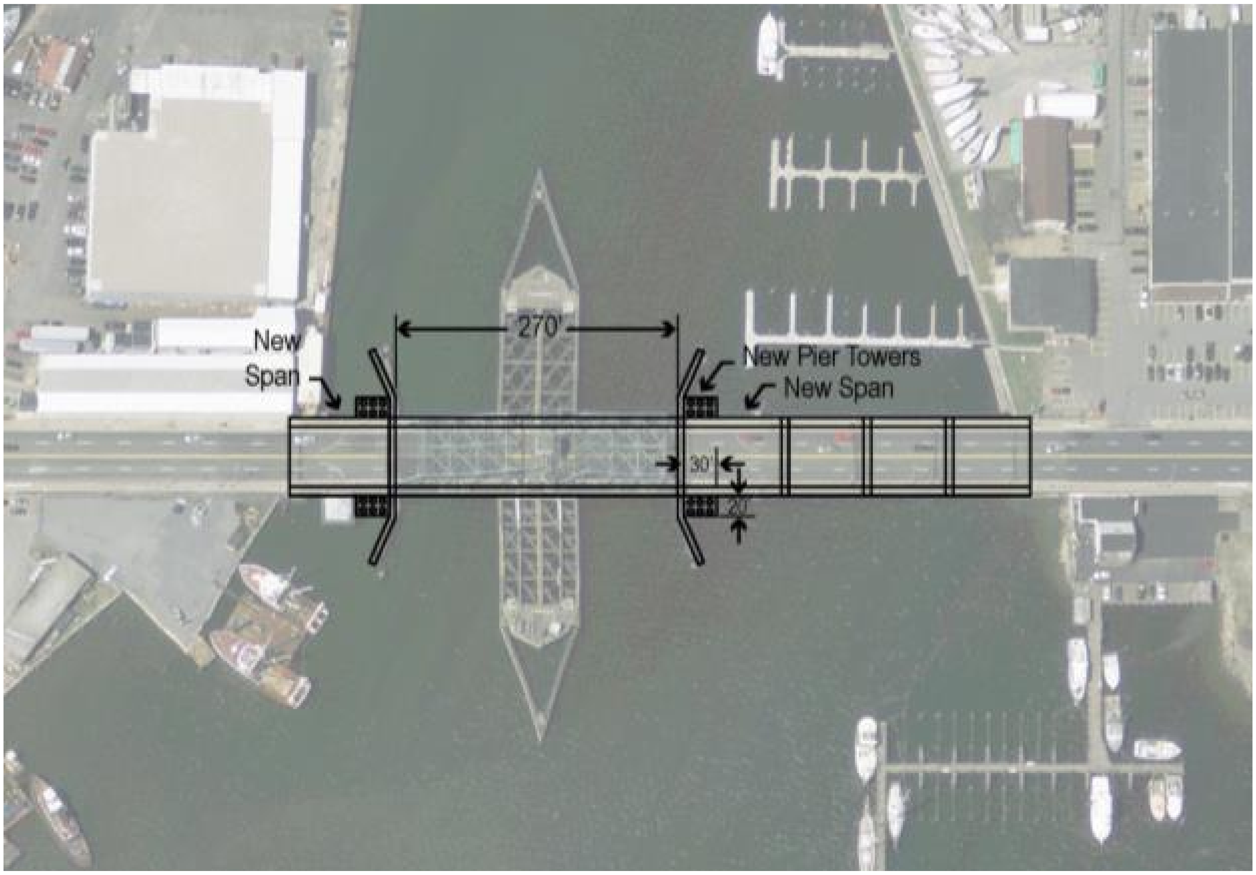
The following sections provide a summary of the eight long-term alternatives. More analysis on each alternative is provided in Chapter 4.

3.2.1 Alternative 1: Vertical Lift Bridge

BRIDGE DESIGN

This alternative constructs a new vertical lift bridge in place of the existing swing bridge. The bridge would include approximately 270 feet of navigational clearance and would only allow for approximately 110-135 feet of vertical clearance. As shown in Figure 3.4, the bridge is aligned so that the new pier towers are approximately in the same location as the east and west abutments of the existing swing bridge. The wider horizontal navigational clearance facilitates the construction methodology and would not significantly affect the cost of the bridge.

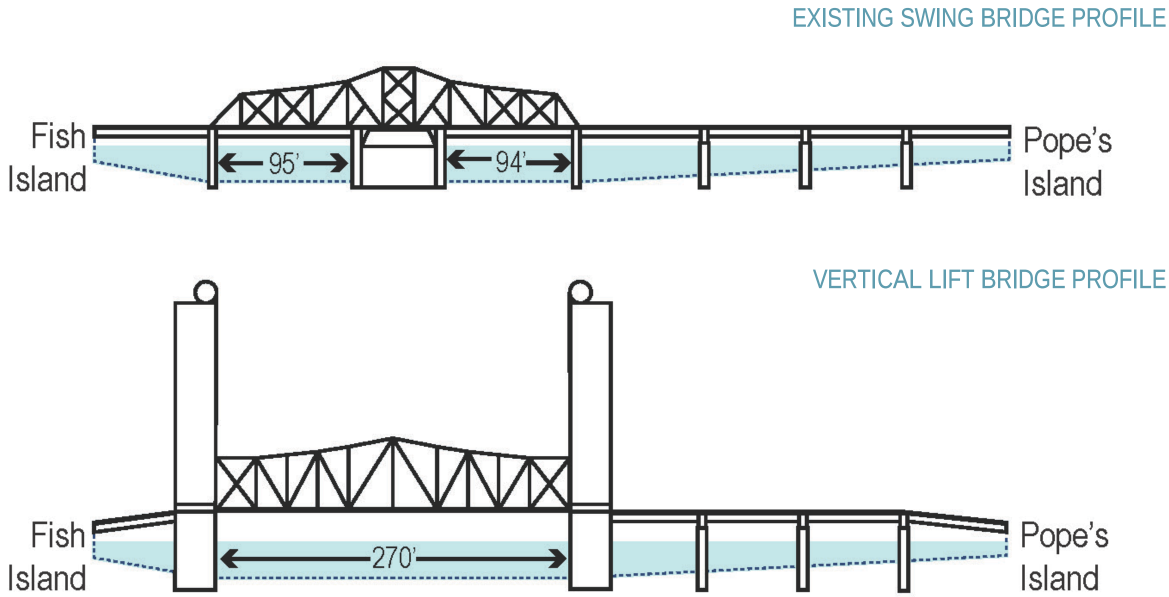
Figure 3.4 Alternative 1: Vertical Lift Bridge Plan



Since this bridge is approximately eight feet higher than the existing bridge, the two approach spans would be reconstructed. The new approach spans could use the same support pile structures, but the superstructure would need to be rebuilt to facilitate the grade change. Additional work would be required on the roadway approach located on Fish's Island. This segment would need to be raised by up to eight feet and would result in the construction of retaining walls between the sidewalk and the adjacent property for approximately 100 feet.

The profile would include the construction of four towers that would extend approximately 155 feet above the bridge deck, or 170 feet above the water line. These towers include the mechanical equipment used to raise and lower the bridge structure. As shown in Figure 3.5, the bridge span would be a truss structure, similar in length to the existing swing bridge. This bridge type has the potential to be designed with an approximately 25-foot-high truss structure, compared to the existing superstructure that is 55 feet high. When the bridge is in the open position, the span would be raised approximately 100-125 feet in the air above the level of the approach spans.

Figure 3.5 Alternative 1: Vertical Lift Bridge Profile



Like all of the new bridge alternatives, the vertical lift alternative allows for a wider bridge. As shown previously in Figure 3.3, the ROW width of the new bridge would be 64 feet wide. This would allow construction of four eleven-foot-wide vehicular traffic lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks.

CONSTRUCTION PHASING / APPROACH

The construction phase of this project would be approximately three years long, or 33 to 36 months. This alternative would allow two or three traffic lanes to remain open for most of the time to vehicular traffic. Both of the existing navigational channels would be open for most of the construction duration. The first two years of construction would be focused on construction of the towers and off-site fabrication of the bridge span. One navigational closure would be required during a single long-weekend, which would occur in the 28th month of construction. During this weekend outage, the existing swing bridge would be removed while the new lift bridge span would be put into place. During this same month, the roadway would need to be closed for two to four weeks.

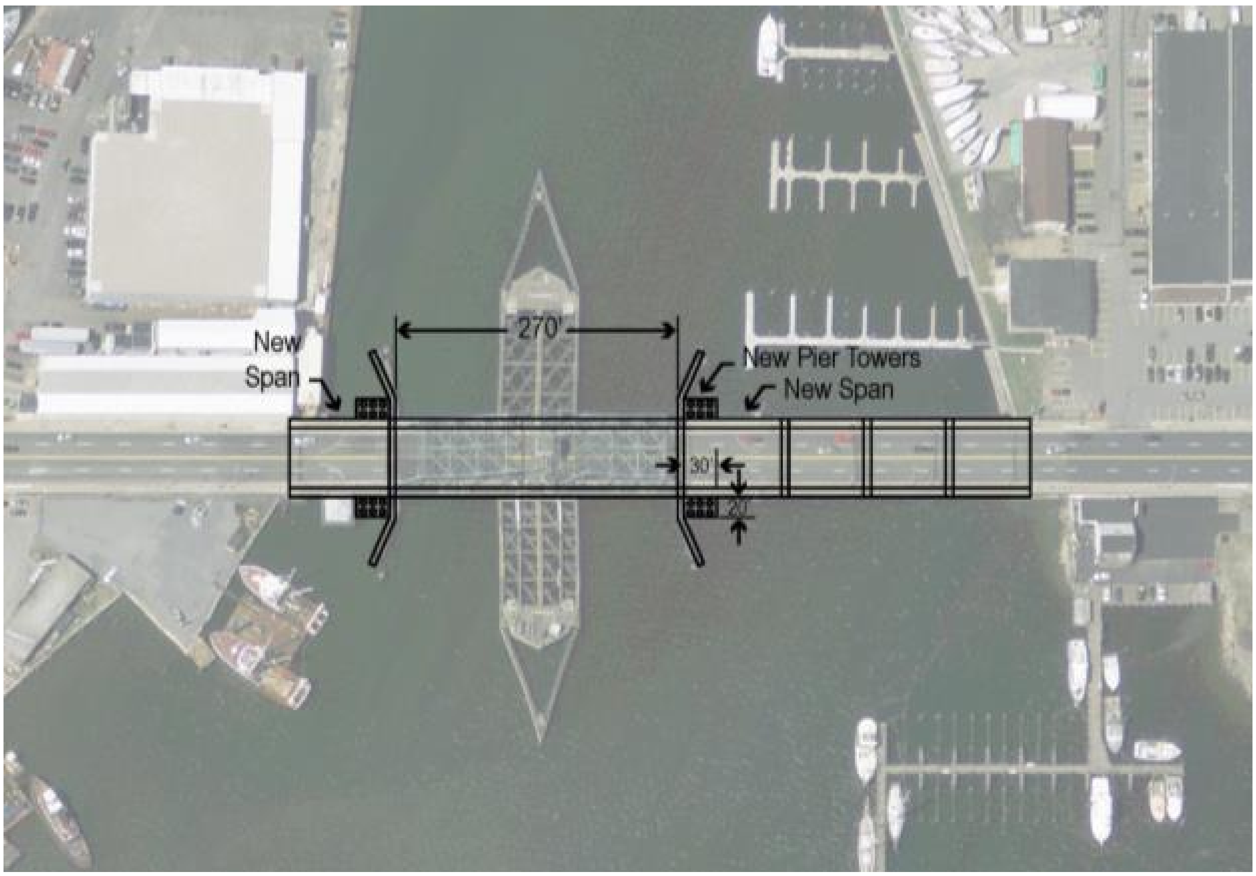
Construction may require extensive in-water work with this alternative. The foundations for the towers would be built just behind the existing swing bridge abutments. Each of the pier towers would be approximately 20 feet by 30 feet. The exact design for these tower foundations will depend upon the soil conditions, and there is a potential that work could be minimized by utilizing a pier foundation system, similar to what would be used for the single-leaf bascule alternative. Additional design would be required before the specific details regarding in-water work could be determined. In addition, the existing swing bridge's center pier structure would need to be removed and would require in-water work and disturbance of existing harbor sediments depending upon the depth of removal.

3.2.2 Alternative 1T: Tall Vertical Lift Bridge

BRIDGE DESIGN

This alternative constructs a new vertical lift bridge in place of the existing swing bridge. The bridge would include approximately 270 feet of navigational clearance, but would only allow for approximately 150 feet of vertical clearance. As shown in Figure 3.6, the bridge is aligned so that the new pier towers are approximately in the same location as the east and west abutments of the existing swing bridge. The wider horizontal navigational clearance is to facilitate the construction methodology and would not significantly affect the cost of the bridge.

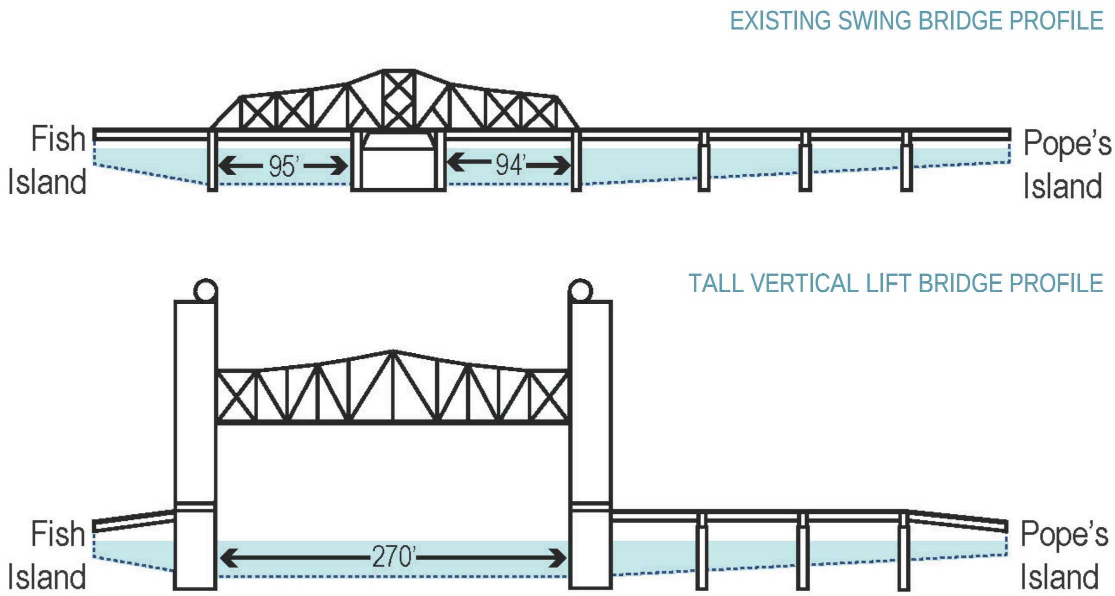
Figure 3.6 Alternative 1T: Tall Vertical Lift Bridge Plan



Since this bridge is approximately eight feet higher than the existing bridge, the two approach spans would be reconstructed. The new approach spans could use the same support pile structures, but the superstructure would need to be rebuilt to facilitate the grade change. Additional work would be required on the roadway approach located on Fish Island. This segment would need to be raised by up to eight feet and would result in the construction of 100-foot-long retaining walls between the sidewalks and adjacent properties.

The profile would include the construction of four towers that would extend approximately 200 feet above the bridge deck, or 190 feet above the water line. These towers include the mechanical equipment used to raise and lower the bridge structure. As shown in Figure 3.7, the bridge span would be a truss structure, similar in length to the existing swing bridge, with the potential of being only approximately 25 feet high, instead of the existing 55 feet high. When the bridge is in the open position, the span would be raised approximately 140 feet in the air above the level of the approach spans.

Figure 3.7 Alternative IT: Tall Vertical Lift Bridge Profile



Like all of the new bridge alternatives, the tall vertical lift bridge alternative allows for a wider bridge, with a 64-foot-wide ROW. This bridge width would allow the construction of four eleven-foot-wide vehicular traffic lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. The cross section for the vertical lift bridge alternative, and all the other build alternatives, is shown in Figure 3.3.

CONSTRUCTION PHASING / APPROACH

The construction phase of this project would be approximately three years long, or 33 to 36 months. This alternative would allow for two or three traffic lanes to remain open for most of the time to vehicular traffic. Both of the existing navigational channels would be open for most of the construction duration. The first two years of construction would be focused on construction of the towers and off-site fabrication of the bridge span. One navigational closure would be required during a single long-weekend, which would occur in month 28 of construction. During this weekend outage, the existing swing bridge would be removed while the new lift bridge span would be put into place. During this same month, the roadway would need to be closed for two to four weeks.

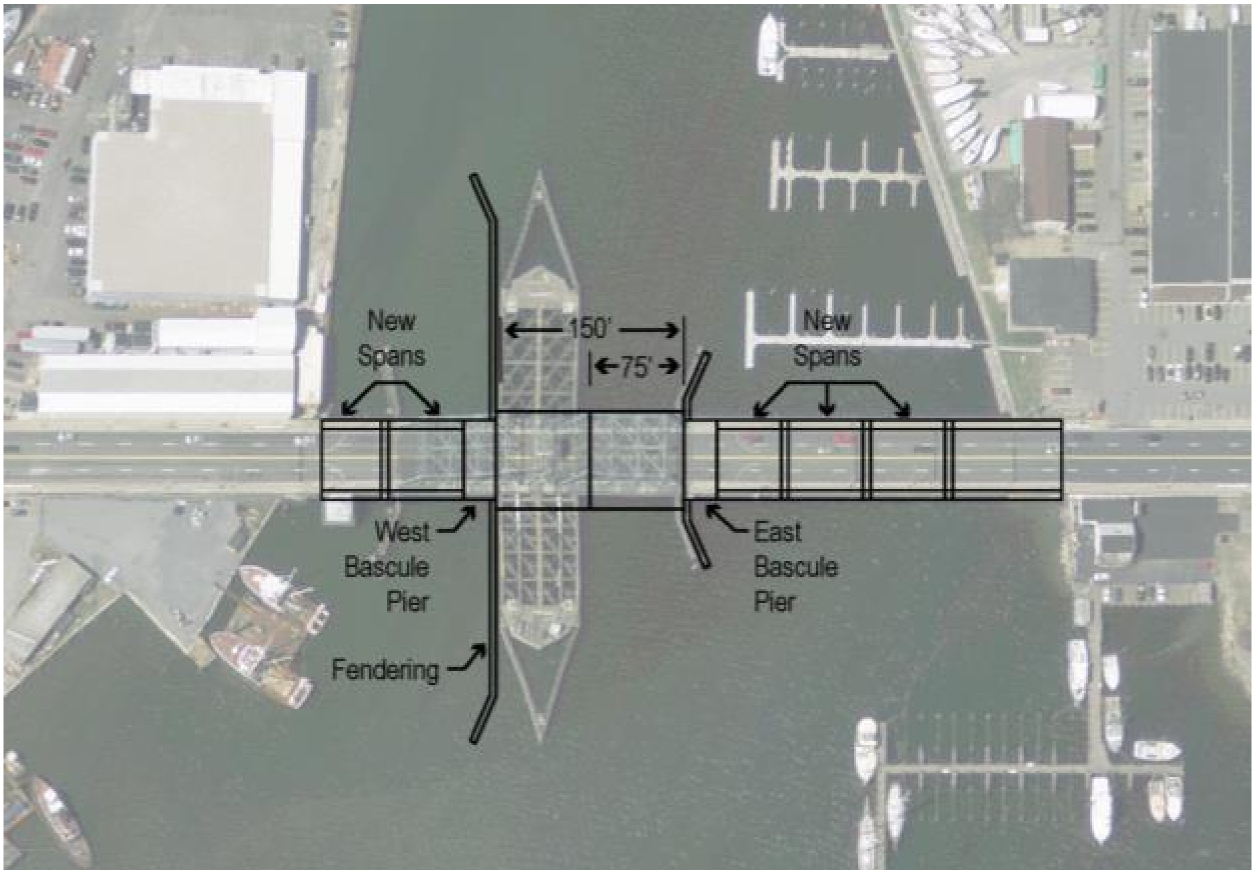
Construction may require extensive in-water work with this alternative. The foundations for the towers would be built just behind the existing swing bridge abutments. Each of the pier towers would be approximately 20 feet by 30 feet. The exact design for these tower foundations will depend upon the soil conditions, and there is a potential that work could be minimized by utilizing a pier foundation system, similar to what would be used for the single-leaf bascule alternative. Additional design would be required before the specific details regarding in-water work could be determined. In addition, the existing bridge's center pier structure would need to be removed and would require in-water work and disturbance of existing harbor sediments depending upon the depth of removal.

3.2.3 Alternative 2: Double-leaf Bascule Bridge (Standard)

BRIDGE DESIGN

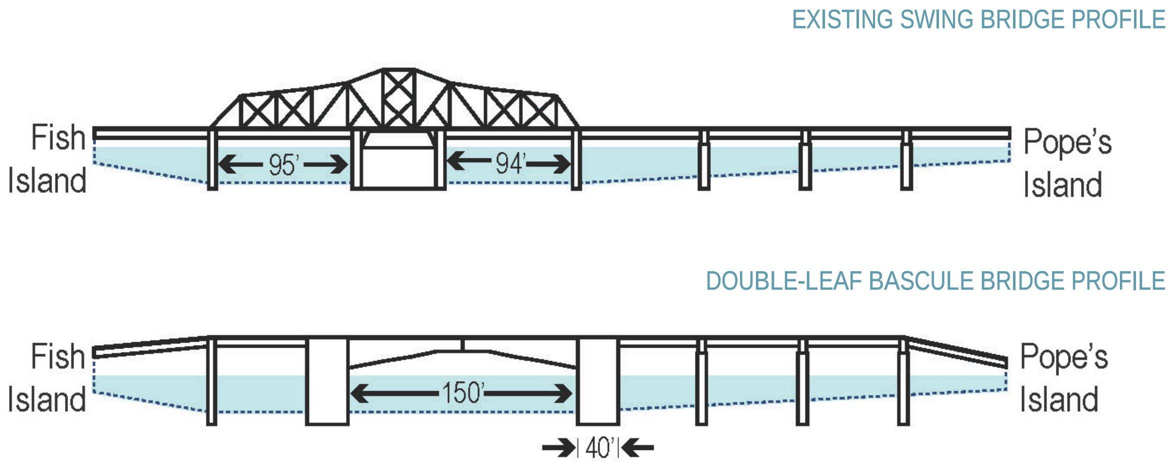
This alternative constructs a new double-leaf bascule bridge in place of the existing swing bridge. The bridge would include approximately 150 feet of navigational clearance and would have no vertical clearance restrictions with the bridge in the open position. As shown in Figure 3.8, the bridge would be aligned with the east bascule pier in the same location as the existing eastern abutment of the swing bridge.

Figure 3.8 Alternative 2: Double-leaf Bascule Bridge Plan



With the bridge being approximately eight feet higher than the existing bridge, the western approach spans would be reconstructed using the same support pile structures, with the superstructure rebuilt to facilitate the grade change. The same would be done to the eastern approach span. As shown in Figure 3.9, the profile of the bridge does not include much structure located above the roadway. The counterweights and mechanical equipment that is necessary to open the bridge is located in the bascule piers below the bridge deck. For bascule bridges, the bridge tender office is usually located, but not required to be located, on the bridge as part of the bascule piers. The specific location would be determined as part of the bridge design process.

Figure 3.9 Alternative 2: Double-leaf Bascule Bridge Profile



Like all of the new bridge alternatives, the double-leaf bascule bridge alternative allows for a wider bridge, with a 64-foot-wide ROW. This bridge width would allow the accommodation of four eleven-foot-wide vehicular traffic lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. The cross section for the vertical lift bridge alternative, and all the other build alternatives, is shown in Figure 3.3.

CONSTRUCTION PHASING / APPROACH

The construction phase of this project would take approximately 37 months. This alternative would consist of closing the bridge to vehicular traffic for approximately two years during that period. One of the two existing navigational channels would be open for most of the construction duration. However, navigational closures would be required during three long-weekends with one during the first year of construction (month 10), and two long weekends during the third year of construction (month 32 and 33).

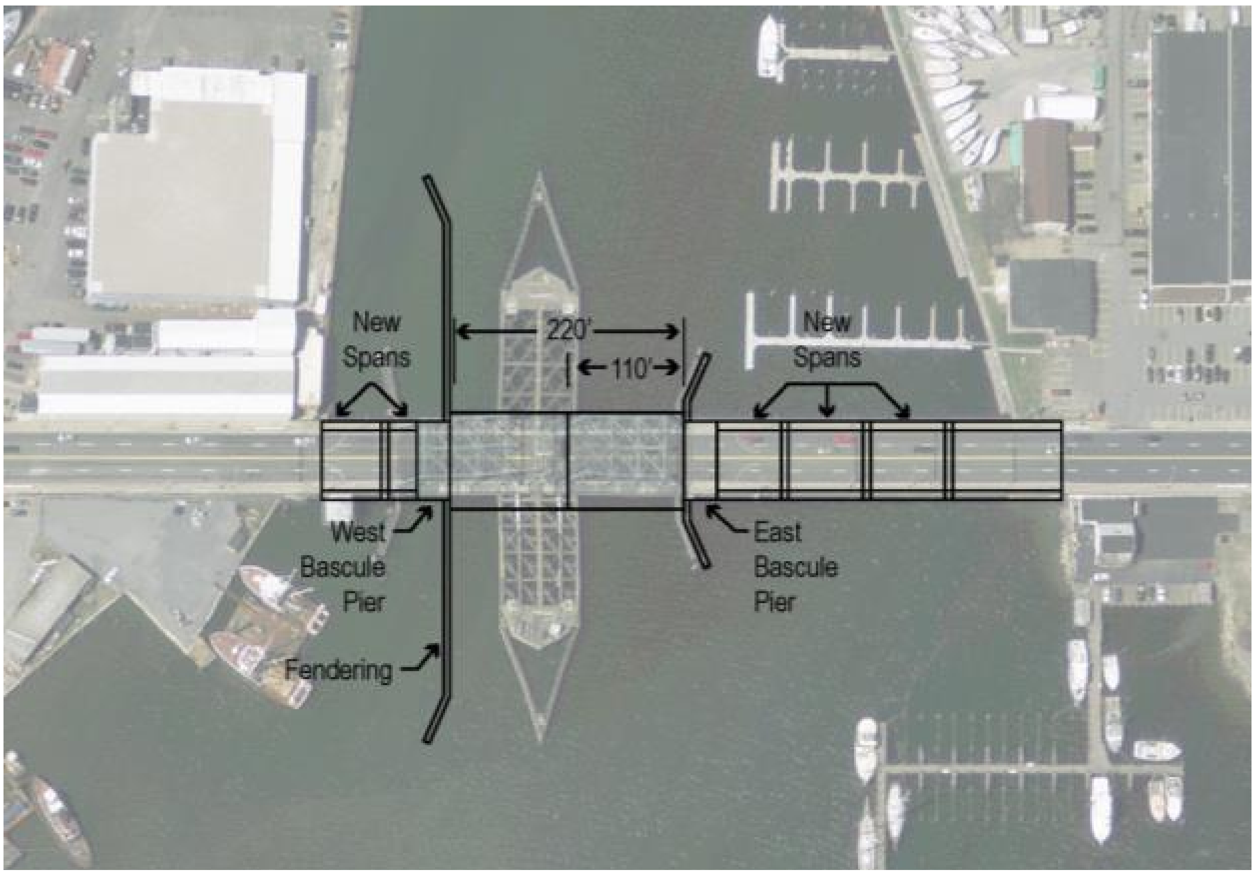
Construction will require extensive in-water work with this alternative. The bascule piers that house the bridge counter weights are located where the bridge leafs "hinge." These structures, which are at least 24 feet by 64 feet, would result in the disturbance of existing soils and the construction of foundations and structures all located under the water line. In addition, the existing swing bridge's center pier structure would need to be removed and would require work in-water. Existing harbor sediments could be disturbed depending upon the depth of removal. The remainder of the bridge construction would be done above the water line.

3.2.4 Alternative 2W: Wide Double-leaf Bascule Bridge (Standard)

BRIDGE DESIGN

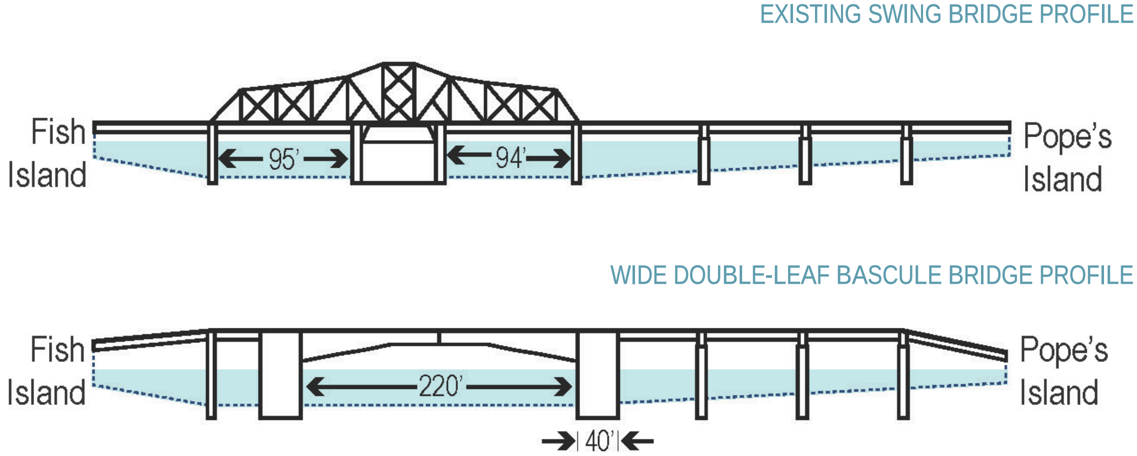
This alternative constructs a new wide double-leaf bascule bridge in place of the existing swing bridge. The bridge would include approximately 220 feet of navigational clearance and would have no vertical clearance restrictions. As shown in Figure 3.10, the bridge would be aligned with the east bascule pier in the same location as the existing eastern abutment of the swing bridge.

Figure 3.10 Alternative 2W: Wide Double-leaf Bascule Bridge Plan



With the bridge being approximately eight feet higher than the existing bridge, the western approach spans would be reconstructed using the same support pile structures, with the superstructure rebuilt to facilitate the grade change. The same would be done to the eastern approach span. As shown in Figure 3.11, the profile of the bridge does not include much structure located above the roadway. The counterweights and mechanical equipment that is necessary to open the bridge is located in the bascule piers below the bridge deck. For bascule bridges, the bridge tender office is usually located, but not required to be located, on the bridge as part of the bascule piers. The specific location would be determined as part of the bridge design process.

Figure 3.11 Alternative 2W: Wide Double-leaf Bascule Bridge Profile



Like all of the new bridge alternatives, the wide double-leaf bascule bridge alternative allows for a wider bridge, with a 64-foot-wide ROW. This bridge width would allow the accommodation of four eleven-foot-wide vehicular traffic lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. The cross section for the vertical lift bridge alternative, and all the other build alternatives, is shown in Figure 3.3.

CONSTRUCTION PHASING / APPROACH

The construction phase of this project would take approximately 37 months. This alternative would consist of closing the bridge to vehicular traffic for approximately two years during that period. One of the two existing navigational channels would be open for most of the construction duration. However, navigational closures would be required during three long-weekends with one during the first year of construction (month 10), and two long weekends during the third year of construction (month 32 and 33).

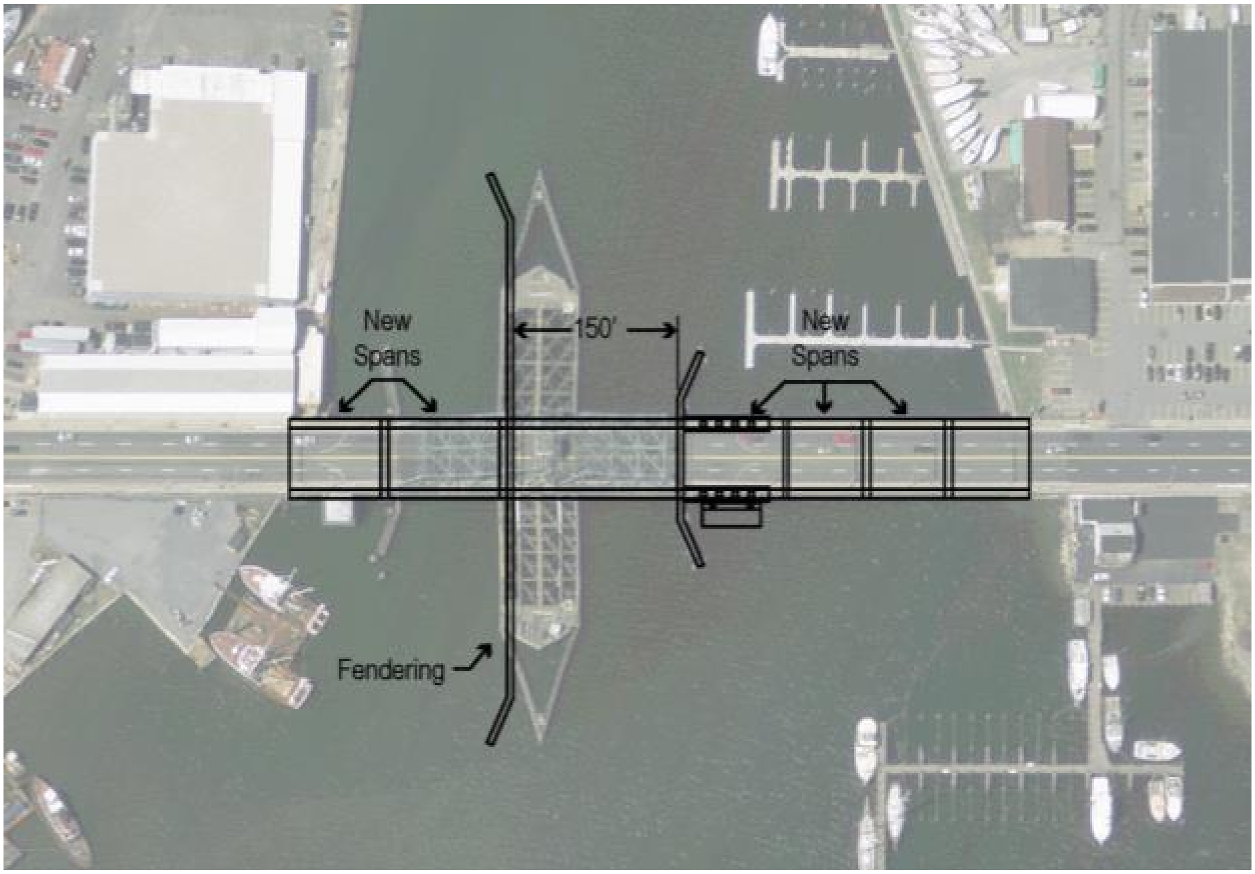
Construction will require extensive in-water work with this alternative. The bascule piers that house the bridge counter weights are located where the bridge leafs "hinge." These structures, which are at least 24 feet by 64 feet, would result in the disturbance of existing soils and the construction of foundations and structure all located under the water line. In addition, the existing swing bridge's center pier structure would need to be removed and would require work in-water. Existing harbor sediments could be disturbed depending upon the depth of removal. The remainder of the bridge construction would be done above the water line.

3.2.5 Alternative 3: Single-leaf Rolling Bascule Bridge

BRIDGE DESIGN

This alternative constructs a new single-leaf rolling bascule bridge in place of the existing swing bridge. Rolling bascule bridges are different from the standard bascule in that the counter-weights are located above the roadway surface and the spans segments are lifted by rolling the bridge into the up position along rails or plates located along the approaches. As shown in Figure 3.12, the bridge would include approximately 150 feet of navigational clearance and would not restrict vertical clearance. The bridge would be aligned with the east bascule pier in the same location as the existing eastern abutment of the swing bridge.

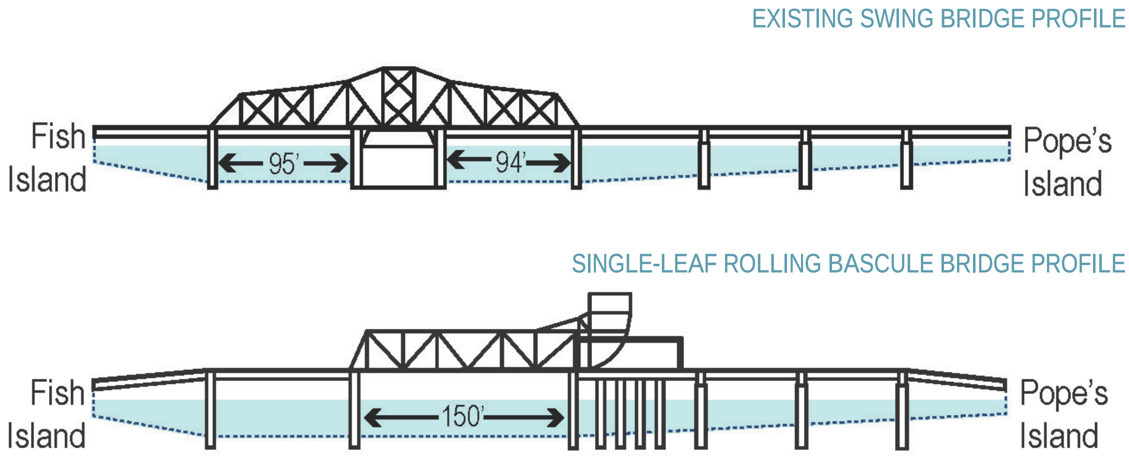
Figure 3.12 Alternative 3: Single-leaf Rolling Bascule Bridge Plan



With the bridge being approximately eight feet higher than the existing bridge, the western approach spans would be reconstructed using the same support pile structures with only the superstructure rebuilt to facilitate the grade change. The same would be done to the eastern approach span.

As shown in Figure 3.13, the profile of the bridge would include a truss structure, similar to the existing bridge structure located above the roadway. In addition, a counterweight would be located above the truss structure. Typically, this counterweight is designed as a large concrete block, although it may be possible to include some aesthetic or iconic masking of the block. The total height of the bridge truss structure and the counterweight would be approximately 55 feet, as high off the roadway as the existing bridge. The bridge would extend approximately 150 feet in the air above the roadway when the bridge is in the open position. As noted in the double-leaf bascule alternatives, the bridge tender office is usually located on the bridge as part of the bascule piers, but is not required to be there. The specific location would be determined as part of the bridge design process.

Figure 3.13 Alternative 3: Single-leaf Rolling Bascule Bridge Profile



Like all of the new bridge alternatives, the single-leaf rolling bascule bridge alternative allows for a wider bridge, with a 64-foot-wide ROW. This bridge width would allow the accommodation of four eleven-foot-wide vehicular traffic lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. The cross section for the vertical lift bridge alternative, and all the other build alternatives, is shown in Figure 3.3.

CONSTRUCTION PHASING / APPROACH

The construction phase of this project would be a little over two years long, or approximately 26-28 months. This alternative allows two vehicular lanes to remain open for most of the construction phase. One of the two existing navigational channels would be open for most of the construction duration. One navigational closure would be required during a single long-weekend, which would occur in month 21 of construction. The new 150-foot-wide channel would then be open during the following month.

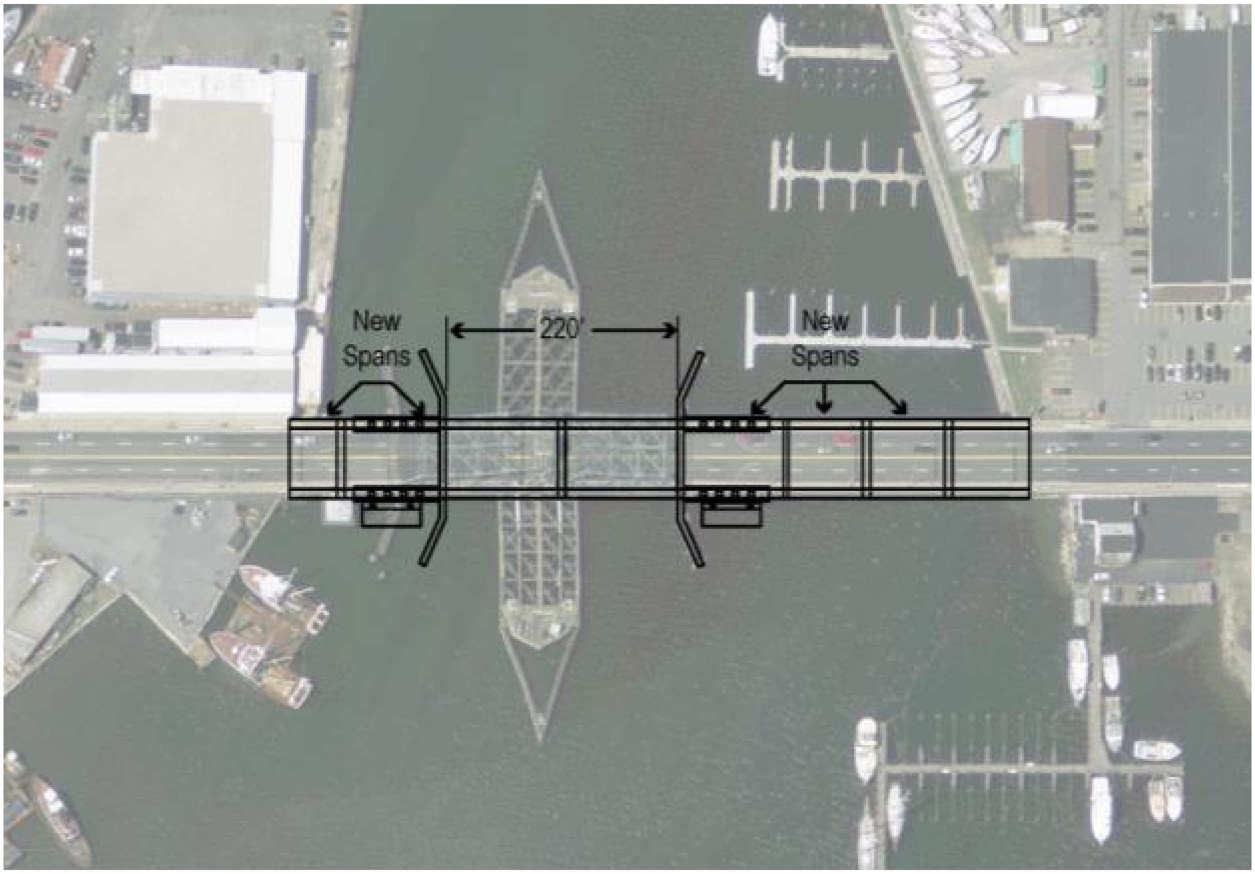
In-water construction work will be limited with this alternative. The bridge structure sits on top of a series of piles, or piers, that would extend from above the waterline, down through the mud and silt to the harbor floor. This foundation type is used for the existing east and west bridges. These piles can be driven in from above, thereby minimizing the work in the water. Furthermore, with the pile configuration possible for this bridge type, most of the piles can be driven with the existing swing bridge in place, thereby minimizing construction disruption. However, the existing bridge's center pier structure would need to be removed and would require in-water work and disturbance of existing harbor sediments depending upon the depth of removal. The remainder of the bridge construction would all be done above the water line.

3.2.6 Alternative 3W: Double-Leaf Rolling Bascule Bridge

BRIDGE DESIGN

This alternative constructs a new double-leaf rolling bascule bridge in place of the existing swing bridge. Rolling bascule bridges are different from the standard bascule in that the counter-weights are located above the roadway surface. As shown in Figure 3.14, the bridge would include approximately 220 feet of navigational clearance and would not restrict vertical clearance when the bridge is in the open position. The bridge would be aligned with the east bascule pier in the same location as the existing eastern abutment of the swing bridge.

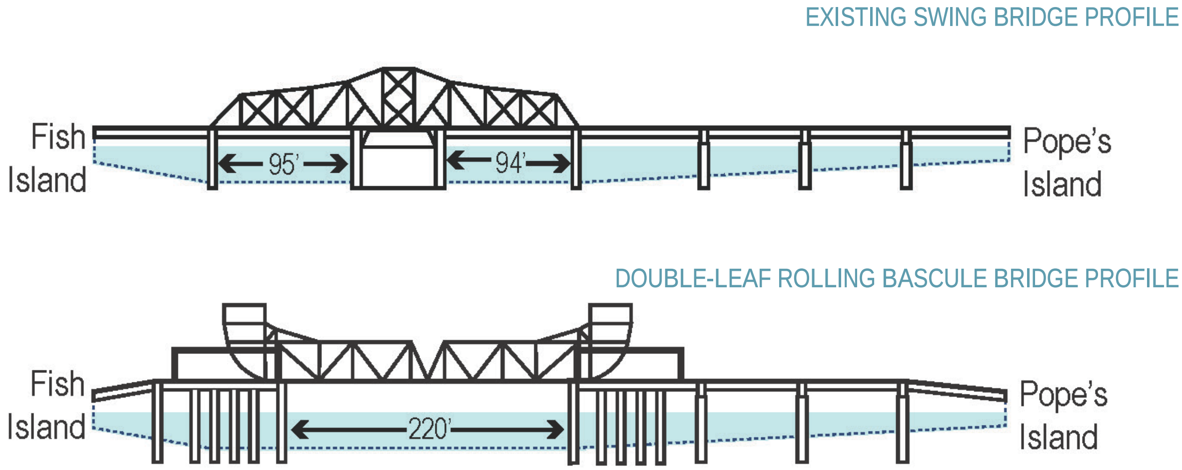
Figure 3.14 Alternative 3W: Double-leaf Rolling Bascule Bridge Plan



With the bridge being approximately eight feet higher than the existing bridge, the western approach spans would be reconstructed using the same support pile structures with only the superstructure rebuilt to facilitate the grade change. The same would be done to the eastern approach span.

As shown in Figure 3.15, the profile of the bridge would include a truss structure, similar to the existing bridge structure located above the roadway. In addition, a counterweight would be located above the truss structure. This is typically designed as a large concrete block, although it may be possible to include some aesthetic or iconic masking of the block. The total height of the bridge truss structure and the counterweight would be approximately 55 feet, as high off the roadway as the existing bridge. The bridge would extend approximately 220 feet in the air above the roadway when the bridge is in the open position. As noted in the double-leaf bascule alternative, the bridge tender office is usually located on the bridge as part of the bascule piers but is not required to be. The specific location would be determined as part of the bridge design process.

Figure 3.15 Alternative 3W: Double-leaf Rolling Bascule Bridge Profile



Like all of the new bridge alternatives, the double-leaf rolling bascule bridge alternative allows for a wider bridge, with a 64-foot-wide ROW. This bridge width would allow the accommodation of four eleven-foot-wide vehicular traffic lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. The cross section for the vertical lift bridge alternative, and all the other build alternatives, is shown in Figure 3.3.

CONSTRUCTION PHASING / APPROACH

The construction phase of this project would be a little over two years long, or approximately 26-28 months. This alternative would allow for keeping two lanes open for most of the time to vehicular traffic. One of the two existing navigational channels would be open for most of the construction duration. One navigational closure would be required during a single long-weekend, which would occur in month 21 of construction. The new 220-foot-wide channel would then be open during the following month.

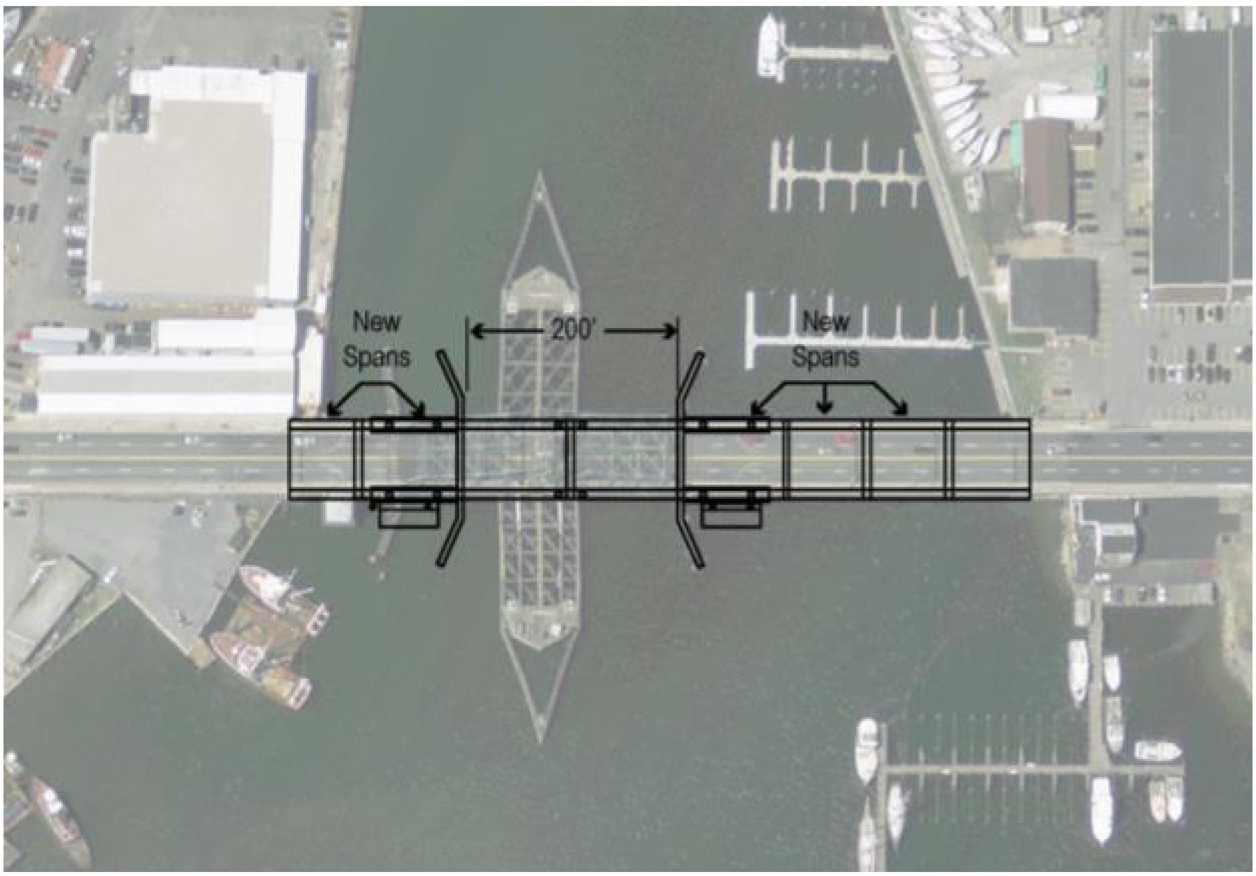
In-water construction work would be limited with this alternative. The bridge structure sits on top of a series of piles, or piers, that would extend from above the waterline, down through the mud and silt to the harbor floor. This foundation type is used for the existing east and west bridges. These piles can be driven in from above, thereby minimizing the work in the water. Furthermore, with the pile configuration possible for this bridge type, most of the piles can be driven with the existing swing bridge in place, thereby minimizing construction disruption. However, the existing bridge's center pier structure would need to be removed and would require in-water work and disturbance of existing harbor sediments depending upon the depth of removal. The remainder of the bridge construction would all be done above the water line.

3.2.7 Alternative 3D: Double-leaf Dutch Bascule Bridge

BRIDGE DESIGN

The final build alternative constructs a new double-leaf Dutch-style bascule bridge in place of the existing swing bridge. Dutch-style bascule bridges are different from the standard bascule in that the counter-weights are located above the roadway surface. As opposed to rolling bascule bridges, the bridge deck of a Dutch-style bascule bridge is lifted using a system that combines the counter-weight, an overhead beam and pivot points, or heel trunnions, for both the beam and the bridge deck. As shown in Figure 3.16, the bridge would include approximately 200 feet of navigational clearance and would not restrict vertical clearance. The bridge would be aligned with the east bascule pier in the same location as the existing eastern abutment of the swing bridge.

Figure 3.16 Alternative 3D: Double-leaf Dutch Bascule Bridge Plan

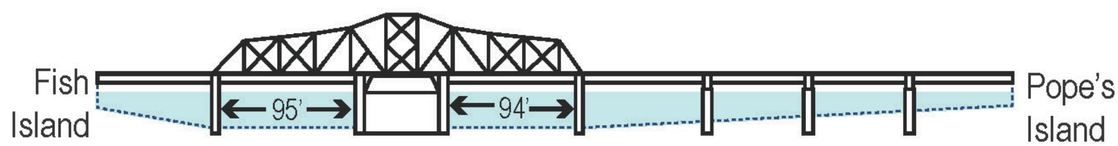


With the bridge being approximately eight feet higher than the existing bridge, the western approach spans would be reconstructed using the same support pile structures with only the superstructure rebuilt to facilitate the grade change. The same would be done to the eastern approach span.

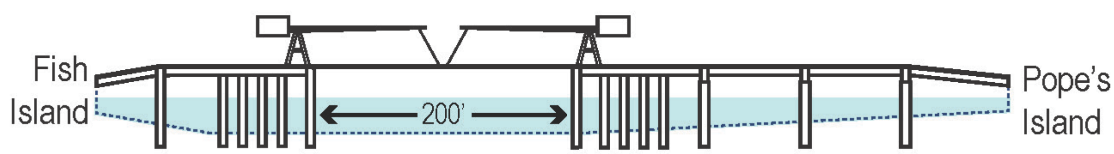
As shown in Figure 3.17, the profile of the bridge would include a beam and counter-weight structure located above the roadway. The counter-weight is typically a large concrete block, although it may be possible to include some aesthetic or iconic masking of the block. The total height of the bridge structure and the counterweight would be approximately 55 feet, which is the same height above the roadway as the truss structure of the existing bridge. The bridge would extend approximately 100 feet in the air above the roadway when the bridge is in the open position. As noted in the double-leaf bascule alternative, the bridge tender office is usually located on the bridge as part of the bascule piers but is not required to be. The specific location would be determined as part of the bridge design process.

Figure 3.17 Alternative 3D: Double-leaf Rolling Bascule Bridge Profile

EXISTING SWING BRIDGE PROFILE



DOUBLE-LEAF DUTCH-STYLE BASCULE BRIDGE PROFILE



Like all of the new bridge alternatives, the Dutch-style bascule bridge alternative allows for a wider bridge, with a 64-foot-wide ROW. This bridge width would include the construction of four eleven-foot-wide vehicular traffic lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. The cross section for the vertical lift bridge alternative, and all the other build alternatives, is shown in Figure 3.3.

CONSTRUCTION PHASING / APPROACH

The construction phase of this project would be a little over two years long, or approximately 26-28 months. This alternative would allow for keeping two lanes open for most of the time to vehicular traffic. One of the two existing navigational channels would be open for most of the construction duration. One navigational closure would be required during a single long-weekend, which would occur in month 21 of construction. The new 200-foot-wide channel would then be open during the following month.

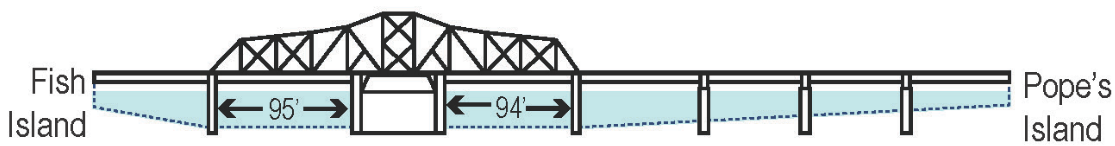
In-water construction work will be limited with this alternative. The bridge structure sits on top of a series of piles, or piers, that would extend from above the waterline, down through the mud and silt to the harbor floor. This foundation type is used for the existing east and west bridges. These piles can be driven in from above, thereby minimizing the work in the water. Furthermore, with the pile configuration possible for this bridge type, most of the piles can be driven with the existing swing bridge in place, thereby minimizing construction disruption.

However, the existing bridge's center pier structure would need to be removed and would require in-water work and disturbance of existing harbor sediments depending upon the depth of removal. The remainder of the bridge construction would all be done above the water line.

3.2.8 No Build Alternative: Repair Existing Swing Bridge

This alternative includes the continued maintenance of the existing swing bridge and repair of the bridge superstructure in the same configuration as currently exists (see Figure 3.18). As noted in Chapter 2, the existing swing bridge was constructed between 1896 and 1903. The bridge received its first major overhaul in 1931 and received minor repairs over the next 30 years, including upgrades to the fender piers, lighting, operator's house, plank decking, and removal of the streetcar tracks. Since the 1960s, bridge repairs have become more frequent and more significant as vehicular traffic over the bridge increased. In 1961, the deck and deck framing of the fixed spans were replaced. Since that time, the bridge has been either repaired or rehabilitated on a 12-year cycle, which is typical of movable bridges located over tidal waterways.

Figure 3.18 Existing Swing Bridge Profile



Based upon conclusions from the 2013 National Bridge Inspection Standards (NBIS) inspection report and an HDR cursory inspection completed in 2014, it is certain that the bridge can be maintained in a reliable operating state for the short-term. However, both the HDR cursory inspection and results from a Preliminary Structures Report conducted for MassDOT in 2010 raised concerns for the long-term future of the 120-year-old structure. Due to the age of some original structural components and the fatigue and stresses that are put on the bridge members on a regular basis, options for replacing the entire swing truss section of the bridge need to be considered. At 120 years, the swing truss section is showing signs that it is beyond its useful life and will need to be replaced. It is estimated that this will need to occur within the next 15 to 20 years.

This alternative includes the ongoing maintenance cycles and the likely replacement needs for the bridge in order to compare replacement alternatives regarding life-cycle costs. The future replacement of the superstructure (or swinging truss section) would not change the attributes of the bridge as identified for the other bridge alternatives, but would require a limited shut down of the navigational channel and roadway.

The construction phase of this project would be approximately 18 months. This alternative would allow for keeping two lanes open for most of the time to vehicular traffic. One of the two existing navigational channels would be open for most of the construction duration. Two navigational closures would be required during a two separate long-weekends, which would occur in the 21st month of construction. In-water construction work will be limited with this alternative.

3.3 DESCRIPTION OF SHORT-TERM/MEDIUM-TERM ALTERNATIVES

The identified long-term alternatives address many of the issues identified in the corridor, specifically those related to marine traffic and land use/economic development. Several additional corridor issues, described previously in Chapter 2, could be addressed through implementation of short- and medium-term improvements. Most of these improvements could be achieved with less financial resources and in a sooner timeframe than the long-term alternatives. While some of them may require fewer resources, timing is important and implementation may be dependent on the completion of other improvements, including a long-term alternative.

The following sections identify potential improvements that could be implemented in these shorter timeframes. They are included in the categories of:

- Corridor Intersections;
- Intelligent Transportation Systems; and
- Bicycle/Pedestrian Facilities.

3.3.1 Corridor Intersections

As described previously in Chapter 2, a 2035 No Build Condition analysis was completed to evaluate the need for potential corridor intersection improvements. Based on the specific issues identified during this analysis (listed in Section 2.10.5), several corridor intersection improvements were identified. The intersections that were identified as having potential issues in 2035 include several signalized intersections along Route 6 on both sides of the New Bedford-Fairhaven Bridge. The analysis indicated that these intersections currently operate or will operate in the future at a level of service (LOS) D or worse. Figure 3.19 shows the intersections along the Route 6 Corridor that were analyzed for improvements.

Figure 3.19 Short-term Corridor Intersection Improvements

Improvements proposed as part of this study are signal-related and do not require high capital costs and ROW acquisitions. They comprise of changing signal timing splits, phasing, coordination offsets, and/or cycle lengths. Since these changes are relatively quick to implement with minor costs and provide immediate benefits to the operations along the corridor, they are designated as short-term improvements. These improvements are expected to benefit the corridor during long-term closure of the bridge for construction.

The following describes the existing and/or future conditions that will necessitate potential improvements.

- **Kempton Street and Cottage Street.** During the AM peak hour, the southbound Cottage Street approach will change from a LOS C under the 2014 Existing Condition to a LOS E under the 2035 No Build Condition.
- **Mill Street and Cottage Street**. During both AM and PM peak hours, all approaches at this intersection operate at mid LOS D or better during the 2035 No Build Condition. However, changes may be possible that would result in better traffic coordination for travelers going in the north/south direction.
- **Mill Street and County Street.** During the PM peak hour, the southbound County Street approach will change from a LOS D under the 2014 Existing Condition to a LOS F under the 2035 No Build Condition.

- **Kempton Street and County Street.** During both AM and PM peak hours, all approaches at this intersection operate at mid LOS D or better during the 2035 No Build Condition. However, changes may be possible to achieve better traffic coordination for travel in the north/south direction and improve southbound conditions at the nearby Mill Street/County Street intersection
- **Route 6 and Pleasant Street (Octopus Intersection)/Route 18 southbound off-ramp.** During both AM and PM peak hours, all approaches at this intersection operate at a LOS E or worse and the overall intersection will operate at LOS F under the 2035 No Build Condition. In addition to signal changes the potential for closing the Route 18 southbound off-ramp to westbound Route 6 will be considered.
- **Main Street and Huttleston Avenue.** During the PM peak hour, the northbound approach of this intersection changes from a LOS D under existing conditions to a LOS E under the 2035 No Build Condition. The southbound approach changes from a low LOS E under the 2014 Existing Condition to a high LOS E under the 2035 No Build Condition. **Middle Street and Huttleston Avenue.** During both AM and PM peak hours, all approaches at this intersection operate at LOS C or better during the 2035 No Build Condition. However, since this intersection has combined signal operations with the intersection of Main Street and Huttleston Avenue, changes to that intersection may impact the Middle Street and Huttleston Avenue intersection
- **Adams Street and Huttleston Avenue.** During the AM peak hour, the northbound approach changes from a LOS C under the 2014 Existing Condition to a LOS F under the 2035 No Build Condition.

3.3.2 Corridor Signage/Intelligent Transportation Systems (ITS)

Roadside variable message signs or Intelligent Transportation Systems (ITS) are used to inform motorists of bridge closures, accidents, or other issues that cause delays in an effort to allow drivers to alter their routes accordingly. The types of ITS signage are diverse and can vary based on application. Some signs are portable, allow for variable messages, use different technology to transmit messages, and are used for a variety of types of applications.

Each time the New Bedford-Fairhaven Bridge is closed to motorists to allow vessels to transit the bridge, drivers are informed of the closures using a series of signs that are located on the bridge approaches (Figure 3.20). All of the existing signs are ground-mounted except for one sign, which is mounted on a signal mast arm. Five signs are located west of the bridge and three signs are located east of the bridge. Three of the five signs west of the bridge are located at the intersection of Kempton Street and Purchase Street. Two of the five signs west of the bridge are located along Route 18. The three signs located east of the bridge are installed at the intersection of Huttleston Avenue and Main Street, one of which is installed on a signal mast arm.

In the event of bridge closure, the bridge operator can illuminate the signs to display a 'CLOSED" message. However, the existing signs were installed approximately 20 years ago and use unreliable, outdated technology. The bridge operator has no confirmation if the signs are illuminated or not. The unreliability of the technology is compounded by the lack of replacement parts. MassDOT is currently working through a design process for a complete replacement of all eight signs.

During the summer of 2014, the regional Metropolitan Planning Organization (MPO), the Southeastern Regional Planning and Economic Development District (SRPEDD), conducted a study of ITS associated with the bridge. Consistent with the 2014 Existing Condition findings developed for this study, they found that all approach points to the bridge are provided with advanced warning. However, a deficiency was noted at the corner of Huttleston Avenue (Route 6) and Main Street in Fairhaven. At this location, signs are not visible to motorists traveling northbound on Middle Street until they are committed to make a left turn toward the bridge. It was also noted that there are deficiencies for information for motorists that could divert at Route 240 if bridge status information was provided. Results of a survey administered by SRPEDD found that:

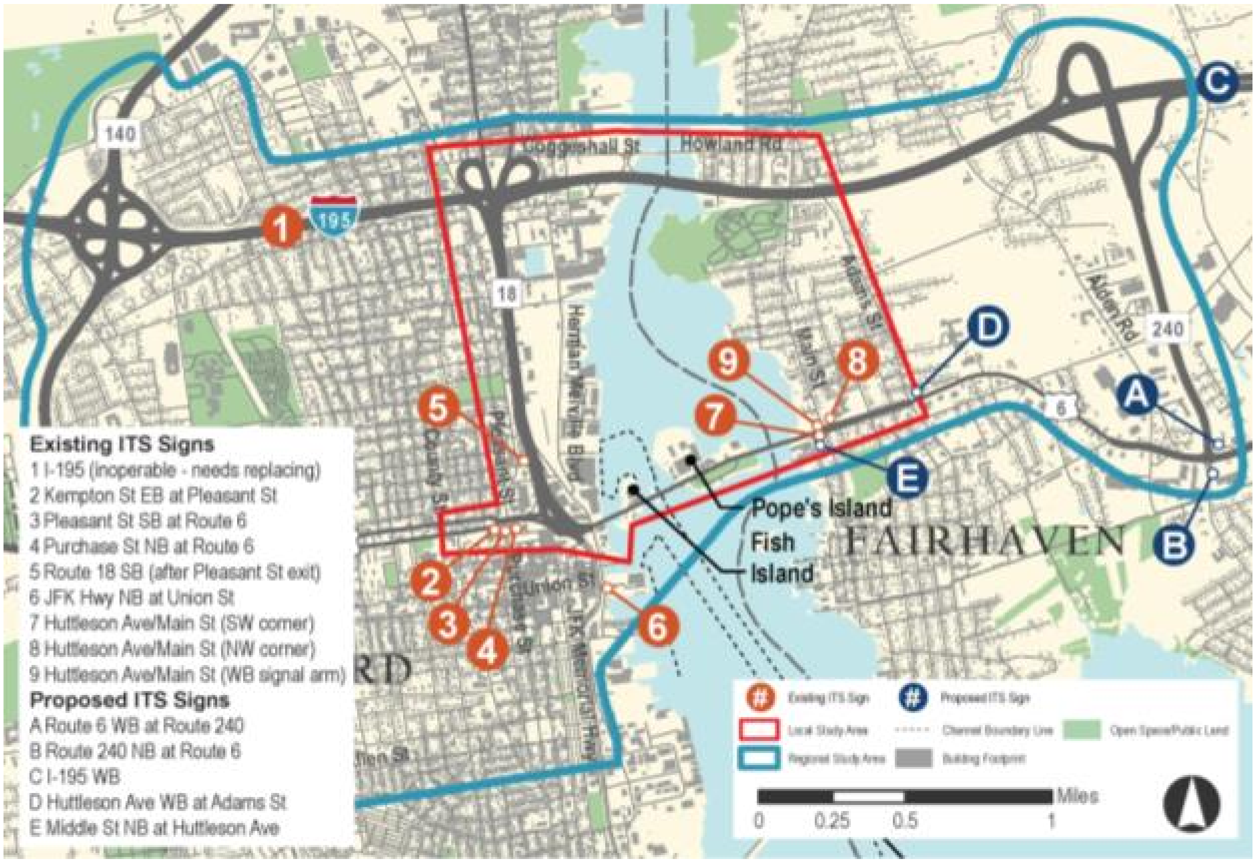
- 88 percent of respondents detour or change their route when the bridge is closed. Of these, 24 percent always change their route and 50 percent will change their route depending on the amount of traffic and / or time.
- Nearly 56 percent of survey respondents do not think the signs provide enough notice / warning to detour their route.

As a result of an assessment of the bridge's ITS system, coupled with the results of the SRPEDD study, the following potential improvements have been identified:

- Complete replacement of the ITS/sign system associated with the bridge.
- Upgrade of the ITS/sign system to provide additional information regarding travel time to the bridge and bridge status.
- Addition of two signs at the Route 6 and Route 240 intersection to facilitate route diversions along Route 240.
- Addition of a sign on I-195 Westbound to replace signs that were previously removed
- Addition of a sign on Route 6 at the Adams Street intersection to facilitate route diversions along Adams Street.
- Addition of a sign that is visible to Middle Street motorists to inform them of bridge closings.

The location of the existing ITS signs and the proposed ITS signs are shown in Figure 3.20.

Figure 3.20 Existing and Proposed ITS Signage Locations



3.3.3 Bicycle/Pedestrian Facilities

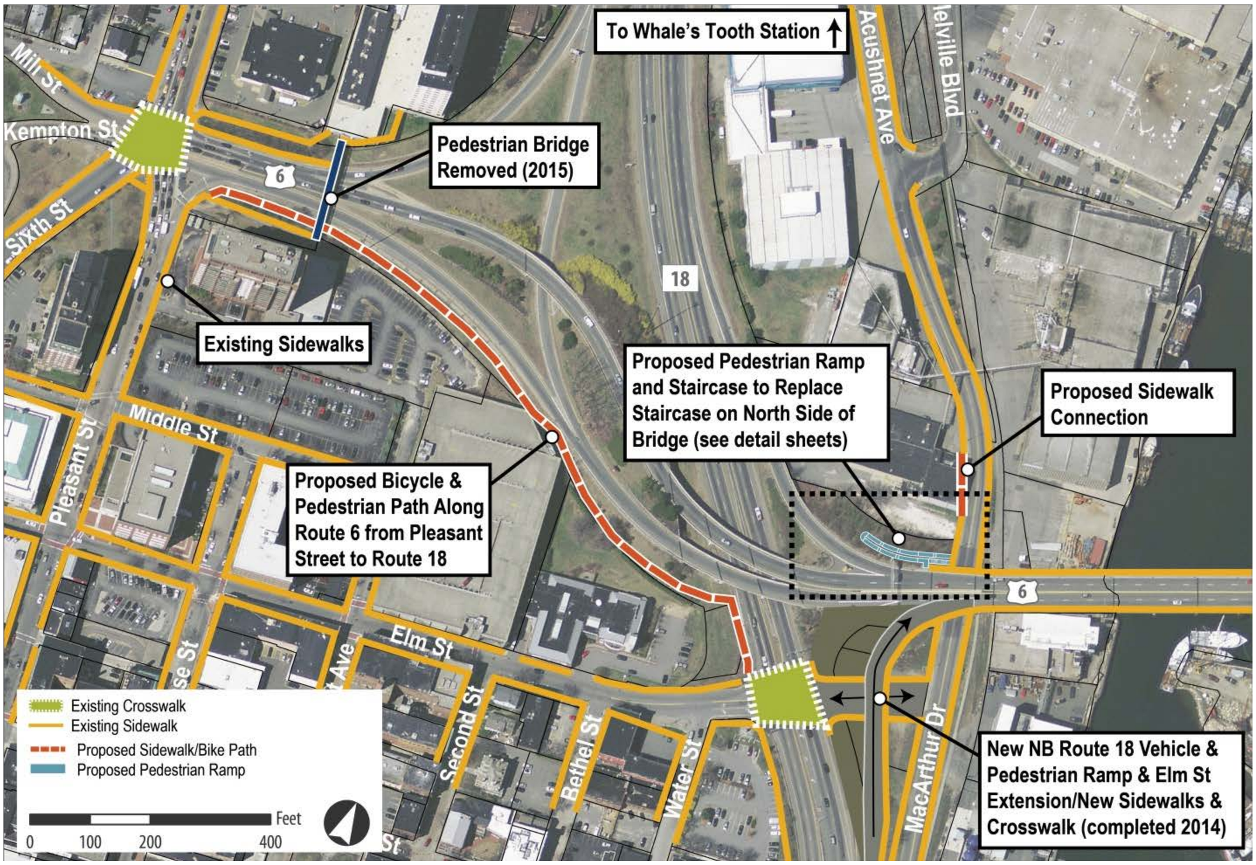
The New Bedford-Fairhaven Bridge is the only pedestrian or bicycle access point between downtown Fairhaven and New Bedford. Pedestrians can use a sidewalk on either side of the travel lanes, but there is only one crosswalk between the New Bedford and Fairhaven shores. Pedestrian access to the bridge from New Bedford is limited to a new pedestrian ramp down to JFK Memorial Highway. A staircase on the north side of the travel lanes down to MacArthur Drive is the only way off the bridge on that side of the highway. Pedestrians and bicyclists are prohibited on Route 6 ramps between Purchase Street and MacArthur Drive. The primary concern along the bridge is the lack of crosswalks. A single crosswalk on Pope's Island provides a safe crossing point for pedestrians between the New Bedford and Fairhaven shorelines.

Additionally, there are no safe routes for bicyclists on the bridge. Many bicyclists use the sidewalks to cross the bridge, which creates additional safety concerns for pedestrians. Access to the New Bedford-Fairhaven Bridge is also limited to the new pedestrian ramp down to JFK Memorial Highway on the south side of the highway.

Based on the bicycle and pedestrian conditions along the corridor, four potential improvements have been identified. Figure 3.21 shows the location of the first three potential improvements:

- Proposed bicycle and pedestrian path along Route 6 from Pleasant Street to Route 18;
- Proposed pedestrian ramp and staircase to replace staircase on north side of bridge;
- Replacement of sidewalk connection along MacArthur Drive to improve access to the South Coast Rail Whale's Tooth Station on Achushnet Avenue; and
- Addition of bike lanes across the entire New Bedford-Fairhaven Bridge by configuration of three-lane roadway cross section.

Figure 3.21 Route 6 Corridor Potential Bike/Pedestrian Improvements in New Bedford



PROPOSED BICYCLE AND PEDESTRIAN PATH BETWEEN PLEASANT STREET TO ROUTE 18

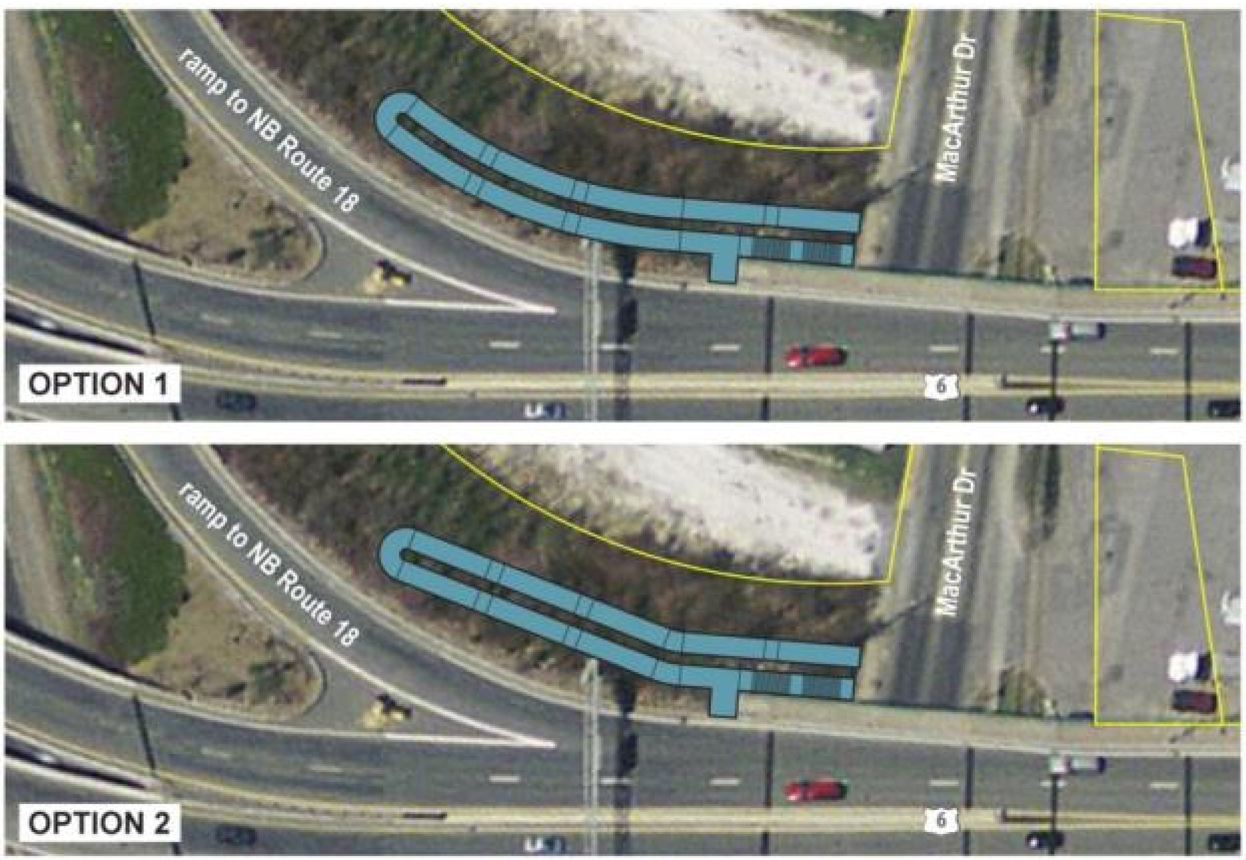
As previously noted, the pedestrian conditions along portions of the Route 6 Corridor are not optimal. The segment of Route 6 between Pope's Island and the "Octopus Intersection" presents multiple challenges. One challenge is the prohibition of pedestrians along the ramp system from the west end of the bridge to the Octopus intersection.

One improvement that has been identified to mitigate that condition is a bicycle/pedestrian path along the southern side of the Route 6 ramp structure to connect the Octopus Intersection area to the Route 18/Elm Street intersection. A project to improve pedestrian conditions at the Octopus intersection is currently being initiated by the City of New Bedford. In addition, a project that improved the pedestrian conditions along Route 18 (JFK Highway) was completed in 2014, including a bike path adjacent to the roadway. The addition of a direct pedestrian connection between these two locations would provide a missing link to the pedestrian network and leverage the improvements that are already being made in New Bedford. The path would be 10 to 12 feet wide, located within the existing Route 6 ROW. A four- to six-foot-high fence would be installed to provide separation between Route 6 and the path.

PROPOSED PEDESTRIAN RAMP AND STAIRCASE ON NORTH SIDE OF BRIDGE

The connection from the sidewalk on the north side of the bridge to New Bedford is limited. The western-most crosswalk on the bridge is located on Pope's Island. Since bicycles and pedestrians are not permitted on the ramp system, the only route off the bridge is down a set of stairs between the bridge and MacArthur Drive. The staircase is not ADA accessible and bicyclists have to unsafely cross Route 6 or backtrack the 2,200 feet to the nearest crosswalk. To improve this connection, a ramp system is proposed from the northern sidewalk to MacArthur Drive in a location similar to the former staircase. Two optional configurations of the ramp structure are included in Figure 3.22. The accessible ramp structure would be constructed within the existing Route 6 ROW. It would include both a new staircase and a 350-foot-long ramp that would facilitate travel from the bridge to MacArthur Drive.

Figure 3.22 Potential Bike/Pedestrian Ramp in New Bedford



REPLACEMENT OF SIDEWALK CONNECTION ALONG ACUSHNET AVENUE

A review of the sidewalk and crosswalk conditions along the corridor reveals that much work has been done in recent years or is currently underway to improve bicycle and pedestrian conditions in the corridor. It was noted that one particular segment of sidewalk is missing along MacArthur Drive just north of Route 6. Limited room is available along MacArthur Drive between the roadway curb line and the adjacent Atlantic Capes Fisheries building. Currently, there is a beaten path along this segment where pedestrians travel along the grassy area. When the Whale's Tooth station opens to the north, it is projected that more pedestrians will utilize this corridor. A sidewalk connection is proposed for this important 85-foot-long segment to remove the gap in the existing network.

ADDITION OF BIKE LANES ACROSS NEW BEDFORD-FAIRHAVEN BRIDGE

The existing conditions for bicyclists across the New Bedford-Fairhaven Bridge are challenging. Prior to disruption caused by ongoing construction, the shoulders along the bridge were generally a maximum of two to three feet wide, with some sections having no shoulder. It is reported that due to these conditions many cyclists ride on the sidewalks. Use of a five-foot-wide sidewalk by both bicyclists and pedestrians is a safety concern.

At the completion of the construction in 2015, all four traffic lanes will be restored. At that time, the travel lanes will be reduced across the entire bridge from the previous 12-foot-wide lanes to 11-foot-wide lanes. This lane reduction will provide adequate room for vehicular traffic while also providing an additional two feet to each shoulder. This will mean that the shoulders will be generally four to five feet wide. Although these will not be striped as bike lanes, the reconfiguration of the lanes along the bridge will result in significant improvement for bicyclists.

At 58 feet wide, the swing bridge cross section is narrower than the remainder of the corridor and this restriping of the lanes will result in a shoulder that is still only two feet wide. Figure 3.23 shows the lane configuration that will be in place upon completion of construction in 2015.

As noted in the previous discussions of long-term bridge alternatives, a wider bridge cross section is being considered. As shown in Figure 3.24, the new bridge alternatives would allow for a four- to five-foot-wide bike lane/shoulders across the entire bridge. This would represent a significant improvement in conditions for bicyclists.

Figure 3.23 Post-Construction Route 6 Corridor Lane Configuration (2015)

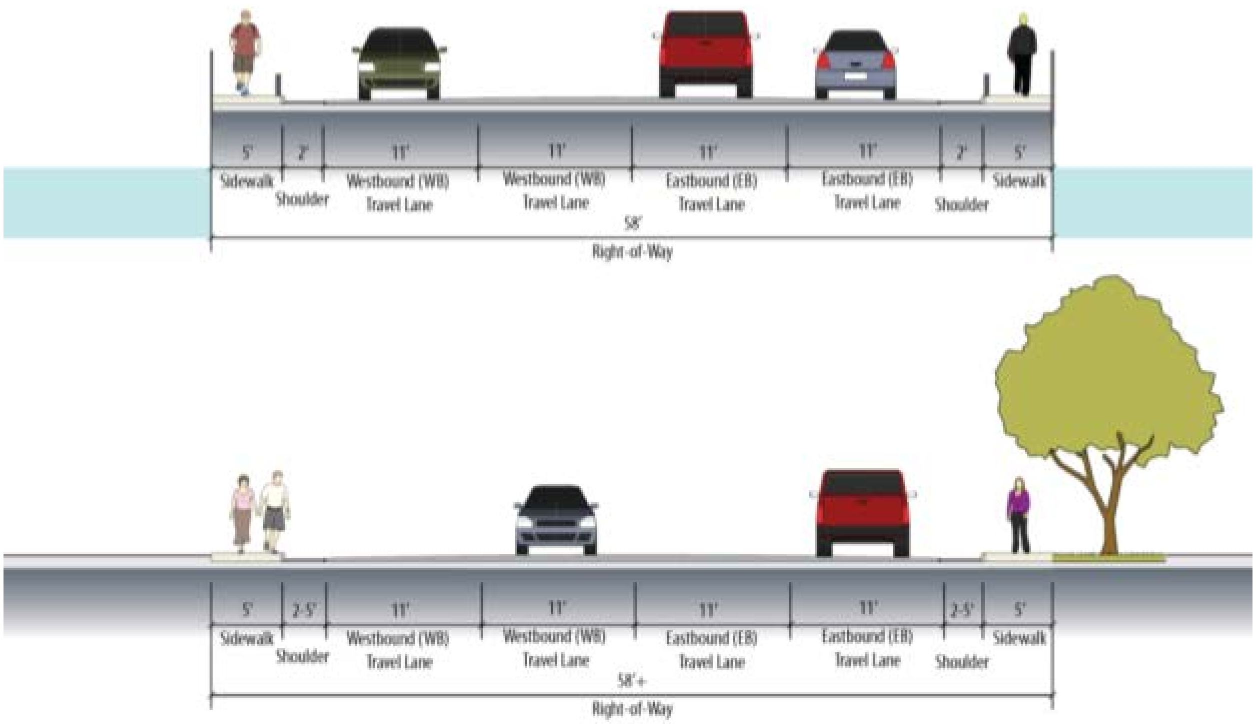
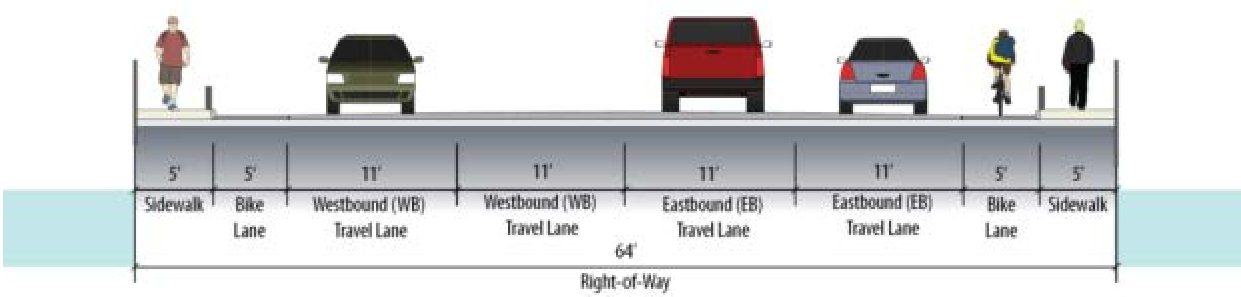


Figure 3.24 Long-term Alternative Bridge Improvement Lane Configuration



Due to space constraints along the existing fixed bridge spans (west bridge and east bridge), additional alternatives to provide improved bicycle facilities were considered. These alternatives would include a reduction of the number of lanes across the bridge from four to three to facilitate additional space that could be striped for bicycle lanes. In this configuration, the cross section would include two 12-foot–wide vehicular traffic lanes and two seven-foot-wide bicycle lanes. The third central vehicular traffic lane would be utilized alternatively as an additional eastbound or westbound travel lane or as a left-turn lane.

Two potential lane configuration options were considered. In both options, the lane configuration includes:

- Along the East Bridge between the Fairhaven shore and Pope's Island, there would be two westbound lanes and one eastbound lane.
- Along the West Bridge and Middle Bridge between the New Bedford shore and Pope's Island, there would be two eastbound lanes and one westbound lane.

The two options vary along the Pope's Island segment. In the first option, the middle lane would be used as a left turn lane for eastbound traffic. In the second option, it would include alternating eastbound and westbound left turn "pockets." The two potential options identified for the Pope's Island segment as shown in Figures 3.25 and 3.26. Figure 3.27 shows two cross sections along the Middle Bridge and the Pope's Island segment that would result from this configuration. The cross section locations are indicated on Figures 3.25 and 3.26.

Figure 3.25 Option 1: Pope's Island Segment Eastbound Left-Turn Lane Configuration

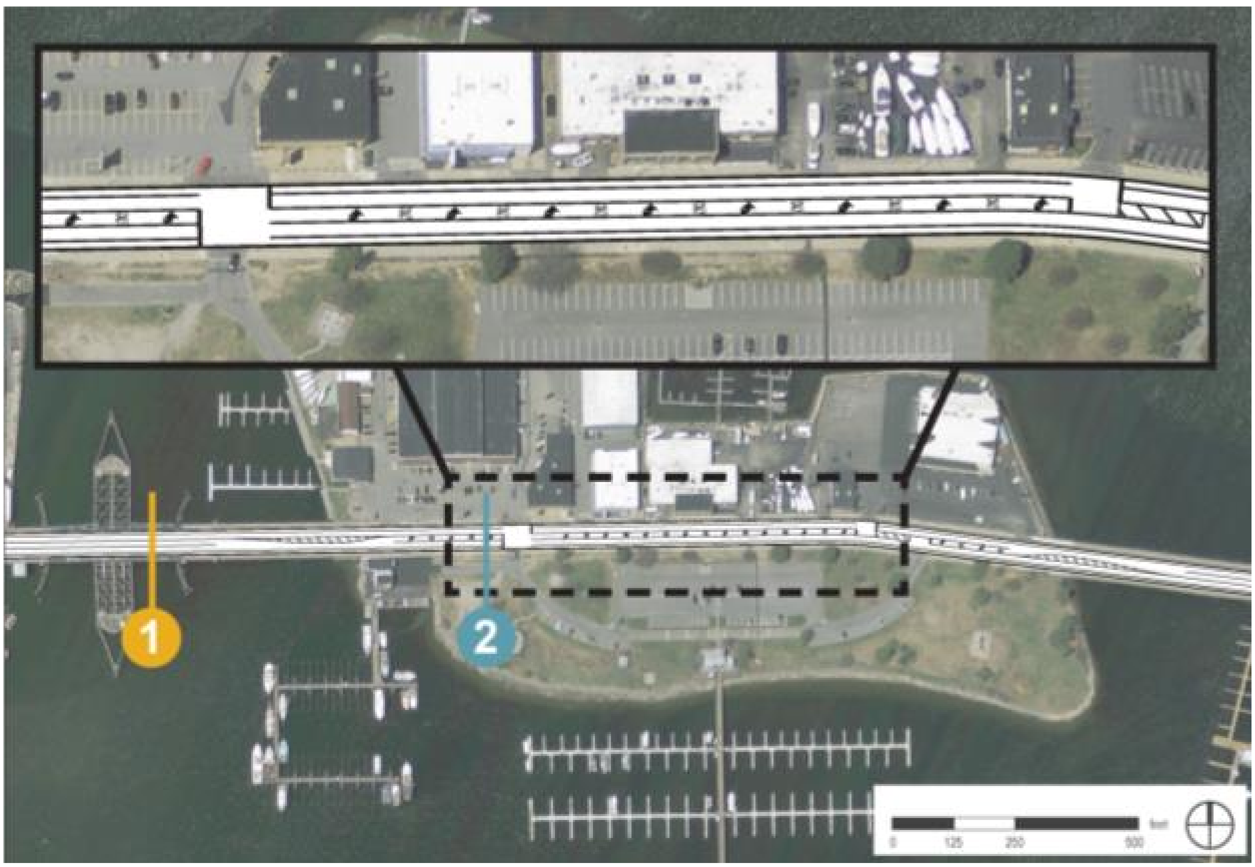


Figure 3.26 Option 2: Pope's Island Segment Left-Turn "Pockets" Lane Configuration

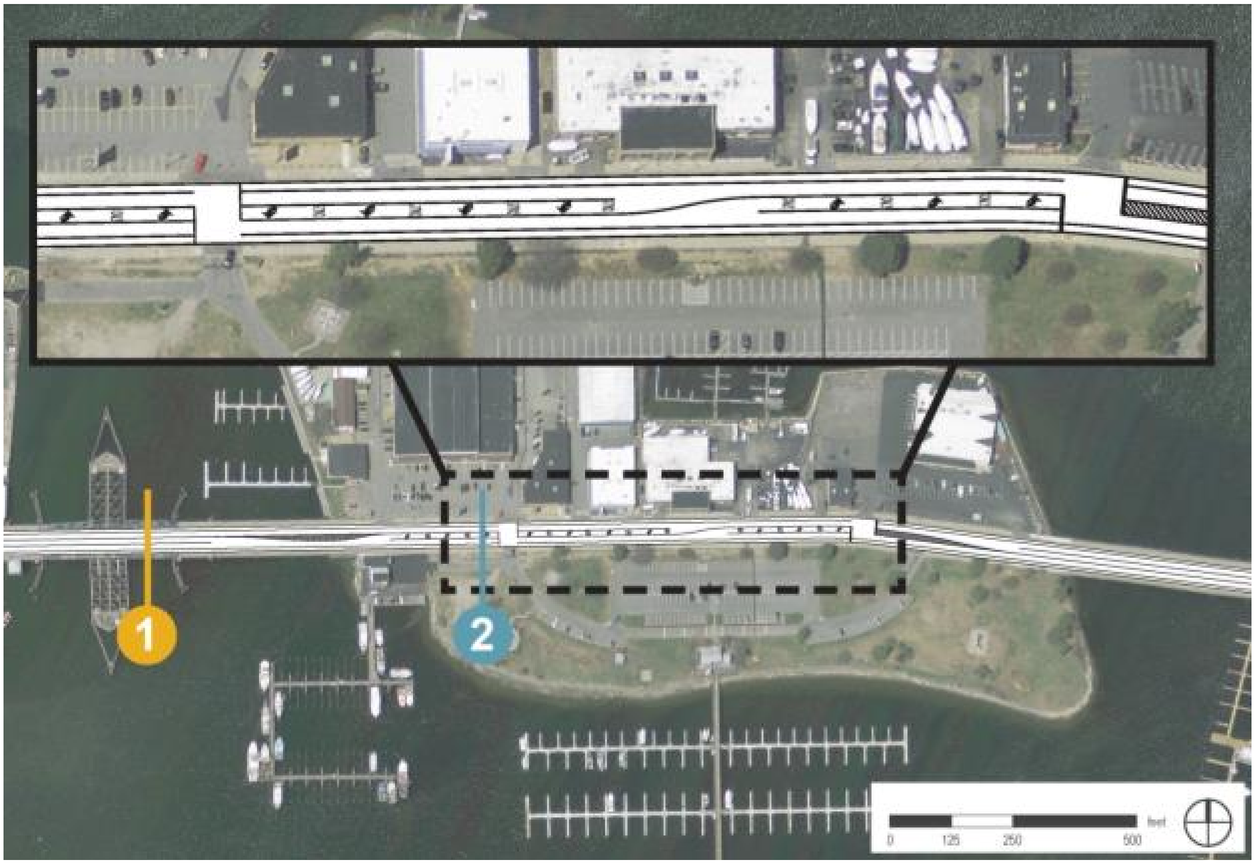
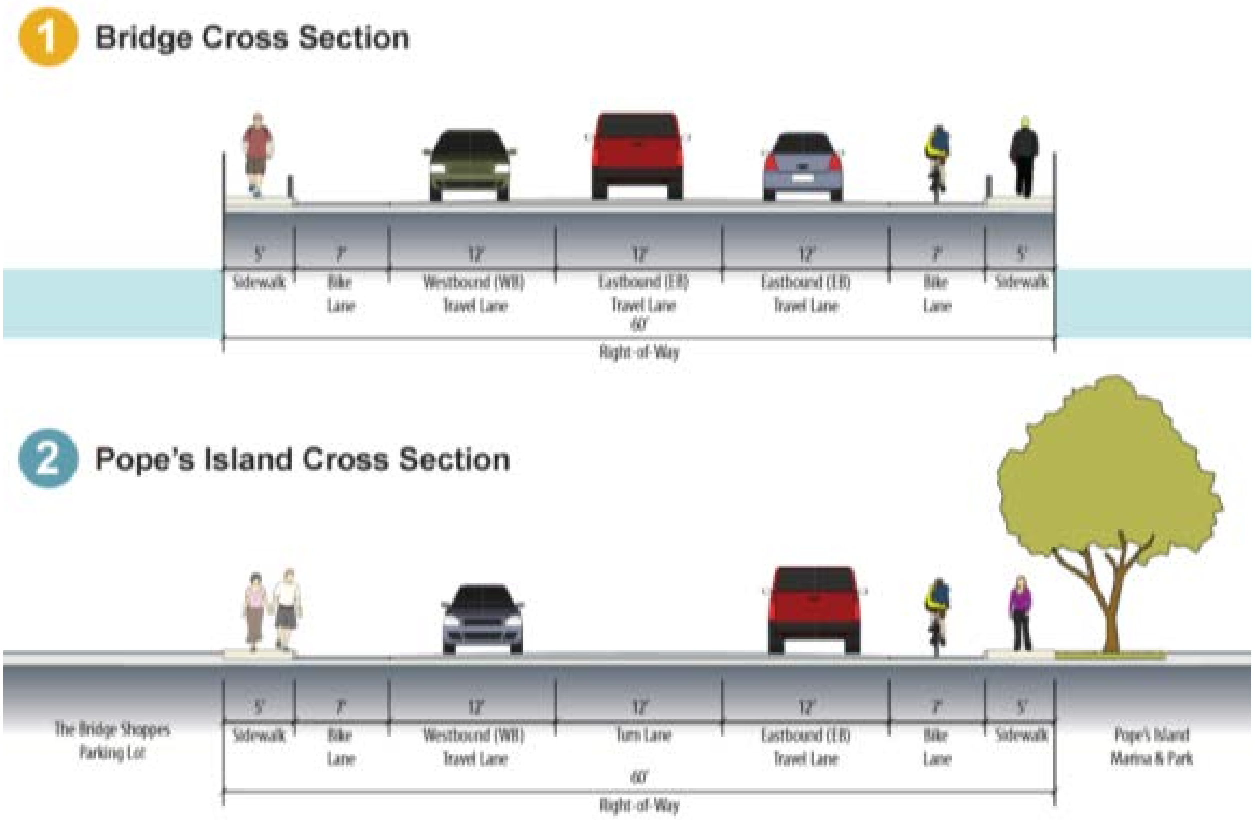


Figure 3.27 Three-lane Configuration Cross Sections



3.4 SUMMARY OF ALTERNATIVES

As part of the alternative development process, the preliminary short-, medium, and long-term alternatives were developed to address the study goals and objectives. The alternatives presented in this chapter underwent a complete analysis and evaluation that is presented in Chapter 4. Each long-term alternative is reviewed against the evaluation criteria prepared at the onset of the study. More detail on the short- and medium-term alternatives is also provided in Chapter 4.

4 Alternatives Evaluation

As described in Chapter 3, eight different long-term alternatives were defined to meet the study goals and objectives. The long-term alternatives advanced into an alternatives analysis process based on the evaluation criteria developed at the beginning of the study and discussed in Chapter 1. The long-term alternatives include seven different build alternatives, as well as a No Build Alternative that includes the repair of the existing bridge. As summarized in Chapter 3, the build alternatives have a variety of horizontal clearances and include one of three different bridge types.

This chapter provides a summary of the alternatives evaluation process and more detailed analysis of each long-term alternative. The summary section includes an evaluation matrix that compares all of the long-term alternatives. The following sections provide the detailed analysis of each alternative, including the results of the evaluation and identification of additional impacts assessment that would likely be needed. The detailed analysis sections also includes a discussion of the mitigation that may be required for any project that would be moved forward into the project development process.

The end of the chapter includes more detailed analysis of the short- and medium-term alternatives introduced in Chapter 3. These nearer term alternatives are focused on intersection, bicycle/pedestrian, and ITS/signage improvements that could be made prior to, in conjunction with, or following the completion of one of the long-term alternatives.

4.1 SUMMARY OF LONG-TERM ALTERNATIVES EVALUATION

At the onset of the study process, a set of evaluation criteria were established to help analyze the long-term alternatives that were developed. The evaluation criteria are comprehensive and address the following topics: bridge operations, transportation impacts, safety, economic development, environment, community, and alternative feasibility.

Table 4.1 and 4.2 provides a summary of the evaluation of the long-term alternatives. The first four alternatives (Alternatives 1, 1T, 2, and 2W) are included in Table 4.1 and the remaining alternatives (Alternatives 3, 3W, 3D, and No Build) are provided in Table 4.2.

Each evaluation criteria is listed along with a summary of the evaluation for each alternative. In addition to the quantitative or qualitative information provided, the table includes an indication, or rating, to the significance of the impact or benefit in a graphical manner. The following is the legend for a rating system utilized:

● = Minor Negative Impact or Most Positive Benefit

◒ = Moderate Impact or Minor/Moderate Positive Benefit

○ = Significant Negative Impact or Least Positive Benefit

Table 4.1. Summary of Alternatives Evaluation (Alternatives 1, 1T, 2, and 2W)

Evaluation Category	Evaluation Criteria	Alternative 1: Vertical Lift Bridge (Rating)	Alternative 1T: Tall Vertical Lift Bridge (Rating)	Alternative 2: Double-leaf Bascule (Rating)	Alternative 2W: Wide Double-leaf Bascule (Rating)
Bridge Operations					
Bridge opening times	Minutes per bridge closure (shortest)	7.5 minutes ◒	7.5 minutes ◒	7.5 minutes ◒	7.5 minutes ◒
Vertical clearances	Feet of vertical clearance (height for vessels)	110-135 feet ○	150 feet ○	Unlimited ●	Unlimited ●
Horizontal clearances	Feet of horizontal clearance (width for vessels)	270 feet ●	270 feet ●	150 feet ◒	220 feet ◒
Estimated number of daily bridge openings	Number per day	11 to 20 ◒	11 to 20 ◒	11 to 20 ◒	11 to 20 ◒
Long-term reliability risk	Long-term reliability risk	Medium Risk ◒	Medium Risk ◒	Medium Risk ◒	Medium Risk ◒
Transportation Impacts & Mobility					
Operational functionality	Corridor intersections level of service (LOS)	No Change ◒	No Change ◒	No Change ◒	No Change ◒
Operational functionality	Corridor volume to capacity ratios	No Change ◒	No Change ◒	No Change ◒	No Change ◒
Operational functionality	Change in 50th and 95th percentile queues	No Change ◒	No Change ◒	No Change ◒	No Change ◒
Travel time	Average roadway travel time along corridor	No Change ◒	No Change ◒	No Change ◒	No Change ◒
Travel time	Average roadway delay (regional)	No Change ◒	No Change ◒	No Change ◒	No Change ◒
Travel time	Average roadway delay (Route 6)	No Change ◒	No Change ◒	No Change ◒	No Change ◒
Travel time	Average transit service delay	N/A	N/A	N/A	N/A
Travel time	Average vessel delay	Reduces/Eliminates Delay ◒	Reduces/Eliminates Delay ◒	Reduces/Eliminates Delay ◒	Reduces/Eliminates Delay ◒
Pedestrian and bicycle mobility and connectivity	Compliance with ADA requirements	Compliant ◒	Compliant ◒	Compliant ◒	Compliant ◒
Pedestrian and bicycle mobility and connectivity	Bicycle/pedestrian delay	No Change ◒	No Change ◒	No Change ◒	No Change ◒
Pedestrian and bicycle mobility and connectivity	Provision of bicycle facilities	Provided (wider shoulders) ●	Provided (wider shoulders) ●	Provided (wider shoulders) ●	Provided (wider shoulders) ●
Pedestrian and bicycle mobility and connectivity	Provision of pedestrian facilities	Provided (sidewalks) ◒	Provided (sidewalks) ◒	Provided (sidewalks) ◒	Provided (sidewalks) ◒

Evaluation Category	Evaluation Criteria	Alternative 1: Vertical Lift Bridge (Rating)	Alternative 1T: Tall Vertical Lift Bridge (Rating)	Alternative 2: Double-leaf Bascule (Rating)	Alternative 2W: Wide Double-leaf Bascule (Rating)
Safety					
Vehicular safety	Conformance with AASHTO and MassDOT standards	Conforms ◒	Conforms ◒	Conforms ◒	Conforms ◒
Vehicular safety	Delay to emergency vehicle access	No Change ◒	No Change ◒	No Change ◒	No Change ◒
Pedestrian and bicycle safety	Impact to high volume bicycle and pedestrian locations	N/A	N/A	N/A	N/A
Marine safety	Impact to safe navigation	Greatly Improved ●	Greatly Improved ●	Moderately Improved ◒	Moderately Improved ◒
Marine safety	Delay to emergency marine access	Improved ●	Improved ●	Improved ●	Improved ●
Environment					
Environmental impacts	Impact to coastal resources (square feet)	Potential Minor Impacts ◒	Potential Minor Impacts ◒	Potential Minor/Moderate Impacts ◒	Potential Minor/Moderate Impacts ◒
Environmental impacts	Impact to wetland resources (square feet)	Potential Minor Impacts ◒	Potential Minor Impacts ◒	Potential Minor/ Moderate Impacts ◒	Potential Minor/ Moderate Impacts ◒
Environmental impacts	Impact to natural resources	Potential Minor Impacts ◒	Potential Minor Impacts ◒	Potential Minor Impacts ◒	Potential Minor Impacts ◒
Environmental impacts	Impact to air quality and greenhouse gases from idling vehicles	Limited Impacts ◒	Limited Impacts ◒	Limited Impacts ◒	Limited Impacts ◒
Land Use & Economic Development					
Business impact from bridge	Number of businesses impacted	None ●	None ●	None ●	None ●
Business impact from bridge	Value of businesses impacted	N/A	N/A	N/A	N/A
Business impact from bridge	Number of jobs lost from businesses impacted	N/A	N/A	N/A	N/A
Economic benefits from bridge	Shipper cost savings	$480,000 ◒	$480,000 ◒	$480,000 ◒	$480,000 ◒
Community					
Community impacts	Impact to protected and recreational open space	No Impact ●	No Impact ●	No Impact ●	No Impact ●

Evaluation Category	Evaluation Criteria	Alternative 1: Vertical Lift Bridge (Rating)	Alternative 1T: Tall Vertical Lift Bridge (Rating)	Alternative 2: Double-leaf Bascule (Rating)	Alternative 2W: Wide Double-leaf Bascule (Rating)
Community impacts	Impact to historical/archeological resources	Limited Impact ◒	Limited Impact ◒	Limited Impact ◒	Limited Impact ◒
Community impacts	Impact to cultural resources	Replacement of historic bridge ○	Replacement of historic bridge ○	Replacement of historic bridge ○	Replacement of historic bridge ○
Community impacts	Impact to business access	No Impact ●	No Impact ●	No Impact ●	No Impact ●
Community impacts	Impact to environmental justice populations	Limited Impact ◒	Limited Impact ◒	Limited Impact ◒	Limited Impact ◒
Visual impacts	Visual impacts	Some Impact ○	Some Impact ○	No Impact ●	No Impact ●
Alternative Feasibility					
Cost	Capital costs	$90-$120 Million ○	$100-$130 Million ○	$85-$100 Million ◒	$130-$160 Million ○
Cost	Annual operating and maintenance costs	$490,000 ◒	$490,000 ◒	$490,000 ◒	$490,000 ●
Construction phase impacts	Construction duration	33 months ○	33 months ○	37 months ○	37 months ○
Construction phase impacts	Impacts to vehicular traffic	2 week road closure ●	2 week road closure ●	24 month road closure ○	24 month road closure ○
Construction phase impacts	Impacts to Marine traffic	1 weekend marine closure ●	1 weekend marine closure ●	3 weekend marine closure ○	3 weekend marine closure ○
Construction phase impacts	Direct impact to abutting land owners/businesses	No Direct Impacts ◒	No Direct Impacts ◒	No Direct Impacts ◒	No Direct Impacts ◒
Construction phase impacts	Indirect impacts to abutting land owners/businesses	Significant access impacts ○	Significant access impacts ○	Significant access impacts ○	Significant access impacts ○
Right-of-way impacts	Permanent and temporary right-of-way impacts	None anticipated ●	None anticipated ●	None anticipated ●	None anticipated ●

Table 4.2. Summary of Alternatives Evaluation (Alternatives 3, 3W, 3D, and No Build)

Evaluation Category	Evaluation Criteria	Alternative 3: Single-leaf Rolling Bascule (Rating)	Alternative 3W: Wide Double-leaf Rolling Bascule (Rating)	Alternative 3D: Double-leaf Dutch Bascule (Rating)	No Build: Repair Existing Swing Bridge (Rating)
Bridge Operations					
Bridge opening times	Minutes per bridge closure (shortest)	7.5 minutes ◒	7.5 minutes ◒	7.5 minutes ◒	7.5 minutes ◒
Vertical clearances	Feet of vertical clearance (height for (vessels)	Unlimited ●	Unlimited ●	Unlimited ●	Unlimited ●
Horizontal clearances	Feet of horizontal clearance (width for vessels)	150 feet ◒	220 feet ●	200 feet ●	95 feet ○
Estimated number of daily bridge openings	Number per day	11 to 20 ◒	11 to 20 ◒	11 to 20 ◒	11 to 20 ◒
Long-term reliability risk	Long-term reliability risk	High Risk ○	Medium Risk ○	TBD	Medium Risk ◒
Transportation Impacts & Mobility					
Operational functionality	Corridor intersections level of service (LOS)	No Change ◒	No Change ◒	No Change ◒	1 intersection below LOS D
Operational functionality	Corridor volume to capacity ratios	No Change ◒	No Change ◒	No Change ◒	Corridor V/C ratios acceptable
Operational functionality	Change in 50th and 95th percentile queues	No Change ◒	No Change ◒	No Change ◒	N/A
Travel time	Average roadway travel time along corridor	No Change ◒	No Change ◒	No Change ◒	6.5 to 9 minutes without bridge delay
Travel time	Average roadway delay (regional)	No Change ◒	No Change ◒	No Change ◒	N/A
Travel time	Average roadway delay (Route 6)	No Change ◒	No Change ◒	No Change ◒	3 to 4.5 minutes plus bridge delay
Travel time	Average transit service delay	N/A	N/A	N/A	N/A
Travel time	Average vessel delay	Reduces/Eliminates Delay ◒	Reduces/Eliminates Delay ◒	Reduces/Eliminates Delay ◒	25% of large cargo vessels delayed 1 day
Pedestrian and bicycle mobility and connectivity	Compliance with ADA requirements	Compliant ◒	Compliant ◒	Compliant ◒	Compliant
Pedestrian and bicycle mobility and connectivity	Bicycle/pedestrian delay	No Change ◒	No Change ◒	No Change ◒	Delay due to bridge opening
Pedestrian and bicycle mobility and connectivity	Provision of bicycle facilities	Provided (wider shoulders) ●	Provided (wider shoulders) ●	Provided (wider shoulders) ●	Roadway shoulders on bridge less than 2 feet

Evaluation Category	Evaluation Criteria	Alternative 3: Single-leaf Rolling Bascule (Rating)	Alternative 3W: Wide Double-leaf Rolling Bascule (Rating)	Alternative 3D: Double-leaf Dutch Bascule (Rating)	No Build: Repair Existing Swing Bridge (Rating)
Pedestrian and bicycle mobility and connectivity	Provision of pedestrian facilities	Provided (sidewalks) ◒	Provided (sidewalks) ◒	Provided (sidewalks) ◒	Sidewalks currently exist on bridge
Safety					
Vehicular safety	Conformance with AASHTO and MassDOT standards	Conforms ◒	Conforms ◒	Conforms ◒	Conforms ◒
Vehicular safety	Delay to emergency vehicle access	No Change ◒	No Change ◒	No Change ◒	Need for bridge opening causes delay
Pedestrian and bicycle safety	Impact to high volume bicycle and pedestrian locations	N/A	N/A	N/A	No high volume locations
Marine safety	Impact to safe navigation	Moderately Improved ◒	Greatly Improved ●	Greatly Improved ●	N/A
Marine safety	Delay to emergency marine access	Improved ●	Improved ●	Improved ●	N/A
Environment					
Environmental impacts	Impact to coastal resources (square feet)	Potential Minor Impacts ◒	Potential Minor Impacts ◒	Potential Minor Impacts ◒	N/A
Environmental impacts	Impact to wetland resources (square feet)	Potential Minor Impacts ◒	Potential Minor Impacts ◒	Potential Minor Impacts ◒	N/A
Environmental impacts	Impact to natural resources	Potential Minor Impacts ◒	Potential Minor Impacts ◒	Potential Minor Impacts ◒	N/A
Environmental impacts	Impact to air quality and greenhouse gases from idling vehicles	Limited Impacts ◒	Limited Impacts ◒	Limited Impacts ◒	N/A
Land Use & Economic Development					
Business impact from bridge	Number of businesses impacted	None ●	None ●	None ●	N/A
Business impact from bridge	Value of businesses impacted	N/A	N/A	N/A	N/A
Business impact from bridge	Number of jobs lost from businesses impacted	N/A	N/A	N/A	N/A
Economic benefits from bridge	Shipper cost savings	$480,000 ◒	$480,000 ◒	$480,000 ◒	N/A
Community					
Community impacts	Impact to protected and recreational open space	No Impact ●	No Impact ●	No Impact ●	N/A

Evaluation Category	Evaluation Criteria	Alternative 3: Single-leaf Rolling Bascule (Rating)	Alternative 3W: Wide Double-leaf Rolling Bascule (Rating)	Alternative 3D: Double-leaf Dutch Bascule (Rating)	No Build: Repair Existing Swing Bridge (Rating)
Community impacts	Impact to historical/archeological resources	Limited Impact ◒	Limited Impact ◒	Limited Impact ◒	N/A
Community impacts	Impact to cultural resources	Replacement of historic bridge ○	Replacement of historic bridge ○	Replacement of historic bridge ○	N/A
Community impacts	Impact to business access	No Impact ●	No Impact ●	No Impact ●	N/A
Community impacts	Impact to environmental justice populations	Limited Impact ◒	Limited Impact ◒	Limited Impact ◒	N/A
Visual impacts	Visual impacts	Limited Impact ◒	Limited Impact ◒	Limited Impact ◒	N/A
Alternative Feasibility					
Cost	Capital costs	$50-$70 Million ●	$90-$110 Million ◒	$100-$125 Million ◒	$45 Million ●
Cost	Annual operating and maintenance costs	$408,000 ●	$490,000 ◒	$490,000 ◒	$416,000 ●
Construction phase impacts	Construction duration	26 months ◒	26 months ◒	26 months ◒	18 months ●
Construction phase impacts	Impacts to vehicular traffic	3 month road closure ◒	3 month road closure ◒	3 month road closure ◒	2 week road closure ●
Construction phase impacts	Impacts to Marine traffic	1 weekend marine closure ●	1 weekend marine closure ●	1 weekend marine closure ●	2 weekend marine closure ◒
Construction phase impacts	Direct Impact to abutting land owners/businesses	No Direct Impacts ◒	No Direct Impacts ◒	No Direct Impacts ◒	No Direct Impacts ◒
Construction phase impacts	Indirect impacts to abutting land owners/businesses	Moderate access impacts ◒	Moderate access impacts ◒	Moderate access impacts ◒	Minor-Moderate access impacts ●
Right-of-way impacts	Permanent and temporary right-of-way impacts	None anticipated ●	None anticipated ●	None anticipated ●	N/A

4.2 NO BUILD ALTERNATIVE: REPAIR SWING BRIDGE

This section provides an evaluation of the No Build Alternative, the long-term alternative that includes the continued maintenance of the existing middle bridge. This alternative includes the rehabilitation of the swing span superstructure in the same configuration as it exists today.

The No Build Alternative was evaluated against the evaluation criteria established at the onset of the study. The evaluation criteria are specific measures of effectiveness used to assess benefits and impacts of each long-term alternative. The No Build Alternative is used as a base line for comparison to the other build alternatives described later in this chapter.

The existing bridge structure was constructed between 1896 and 1903 and has undergone a number of repairs and rehabilitations over the last century. The bridge most recently a complete rehabilitation in 1994 and a program of major repairs began in 1999. Although the bridge structure has been rehabilitated and repaired over the years, much of the original superstructure elements remain. As shown in Figure 4.1, the superstructure for this bridge is the swinging portion of the bridge made of steel truss sections and the connected roadway deck.

Figure 4.1. Existing Middle Bridge Swing Span Opening for Marine Traffic

The superstructure of the middle bridge's swing span consists of two main load-bearing trusses (north and south) connected with bracing at both the top and bottom connecting to the bridge cords. A truss bridge has four beams called chords. The two beams on the bottom, the lower chords, run parallel for the length of the bridge. The upper chords run parallel for less than the full length of the bridge. On the middle bridge, the north and south trusses are identical and evenly spaced from the center of the bridge. The two trusses support a floor system that consists of floor beams, stringers, and a grid deck.

In 2010, MassDOT hired Hardesty & Hanover, LLP (H&H) to perform an inspection of the movable segment of the bridge. The inspection was required to investigate cracks in the bottom chord that were documented in an inspection field report from the previous year.

The inspection and resulting report documented that the bridge's truss bottom and top chords are original members. The visual inspection of bridge conditions and results of a fatigue analysis indicated that the bottom chord is at the end of its fatigue life. The inspection results indicate that the span has undergone a significant number of fatigue cycles. As discussed in Chapter 2, it is estimated that the bridge opens and closes at least 4,000 times per year. The report concluded that the bottom chord has exceeded the expected lifetime.

The bottom chord is a critical structural component of the swing span and the repair of this one component would present significant challenges. The 2010 report's recommendation was to take some short-term actions to prolong the life of the structure while decisions on longer-term solutions were made. Bridge inspectors noted that even if the short-term repair were made, critical decisions on long-term solutions (i.e., a new bridge or a truss replacement option), would need to be made by 2016.

Since the original identification of cracks in the bottom chord was made in 2009, the following improvement/repair activities have taken place:

- Bottom chord fatigue cracking repairs (2009);
- Hydraulic system upgrade (2009);
- Hydraulic lift jack bearing plate repairs (2011);
- Electrical system upgrade (2012);
- Floorbreak repairs (2012); and
- End floor beam to bottom chord connection repairs (2014).

It has been assumed that due to a combination of the age of the structure, the condition of the chords, and the complications with a truss rehabilitation option, that a full replacement of the superstructure will be required within the next fifteen years.

4.2.1 Bridge Operations

Under the No Build Alternative, the bridge operations would be the same as they are today. With a new truss superstructure, the operating time for each bridge movement and the daily number of bridge openings would not change. The horizontal and vertical clearance when the bridge is closed will also remain the same.

MINUTES PER BRIDGE CLOSURE

The opening sequence of the bridge in all of the long-term alternatives, including the No Build Alternative, would continue to follow the AASHTO recommendation that requires approximately four minutes to open and an additional four minutes to close. The average time to open and close the bridge will continue to vary based on the marine traffic transit time and the time required to clear pedestrians and vehicles from the movable span before it can open to marine traffic. The minutes per bridge closure in the No Build Alternative is the same as the current condition.

FEET OF VERTICAL CLEARANCE (OPEN & CLOSED)

No changes will occur in the No Build Alternative to increase the existing six feet of vertical clearance above mean high water (MHW) it is in the closed position. The bridge would continue to create no vertical clearance restrictions when the bridge is open to marine traffic.

FEET OF HORIZONTAL CLEARANCE

No changes will occur in the No Build Alternative to increase the 94- and 95-foot horizontal navigational channel widths. The bridge will continue to result in horizontal clearance restrictions when the bridge is open to marine traffic.

NUMBER OF DAILY BRIDGE OPENINGS

As shown in Table 4.3, the bridge operates on a fixed schedule during the daylight hours and on demand at all other times. This schedule and number of daily openings (11-20 per day) are expected to stay the same. Vessels that transit the bridge are not anticipated to experience any change in delay. The number of daily bridge openings is anticipated to stay the same.

Table 4.3. Bridge Operation Schedule

Early AM	AM	PM	Late PM
On Demand	6:00	12:15	On Demand
-	7:00	1:15	-
-	8:00	2:15	-
-	9:00	3:15	-
-	10:00	4:15	-
-	11:15	5:15	-
-	-	6:15	-

LONG-TERM RELIABILITY RISK

Since each moveable bridge includes a complex interaction of mechanical, electrical, and structural components, there is an inherent risk in a moveable bridge that one of these systems will not operate as designed on any particular day and result in the inability for the bridge to open or close. Some moveable bridge types are at greater risk of inoperability than others due to the nature of their design and the conditions and environment that they operate within. As inoperability of a bridge for a period of time results in community and economic impacts, the risk associated with bridge reliability in the long-term was assessed. This included a general assessment of existing bridges of the type and size under consideration in conditions similar to that of New Bedford Harbor and their ability to remain reliable throughout the life span of the bridge. As noted, all moveable bridges are complex and have some long-term reliability risk. The span width and length of a replacement swing bridge (the No Build Alternative) when operating in the marine costal environment of New Bedford Harbor is estimated to have a medium level of risk. It is likely that even with regular maintenance, the bridge would experience some periods of unanticipated inoperability similar to any moveable bridge in the same location.

4.2.2 Transportation Impacts & Mobility Analysis

The evaluation and assessment of mobility along the corridor between County Street in New Bedford and Adams Street in Fairhaven is an important component of this study. Currently, mobility along the corridor is most significantly impacted by the hourly opening of the New Bedford-Fairhaven Bridge. When the bridge is open, meaning it is closed to vehicular traffic, vehicles need to wait between 12.5 to 22.5 minutes while the bridge swings open, marine traffic transits through the bridge, and then the bridge closes. Typical vehicle queues resulting from the bridge openings range from 1,300 feet to 2,000 feet for eastbound traffic and 1,300 to 1,600 feet for westbound traffic.

As detailed in Chapter 2, a corridor capacity analysis was conducted for the 2014 Existing Condition as well as for a future year (2035) without the consideration of any of the proposed long-term alternatives (2035 No Build Condition). It is not anticipated that any of the long-term alternatives will result in the improvement or degradation of traffic along the corridor. Therefore, the 2035 No Build Condition presented in Chapter 2 and the future traffic condition of each long-term alternative (2035 Build Condition) would be the same. For the purposes of clarity, this will be referred to as the 2035 Condition throughout this chapter.

The analysis of traffic conditions was conducted using Synchro software and application of the *Highway Capacity Manual* based methodology to determine the future performance metrics such as volume-to-capacity ratio, delay, and level of service (LOS). As described in this section, none of the long-term alternatives, including the No Build Alternative, will change vehicular traffic along the corridor. Each of the long-term alternatives will result in the same number of bridge openings and the bridge will on average be open for the same duration. Additional information regarding the 2035 Condition is included in Chapter 2.

CORRIDOR INTERSECTION LEVEL OF SERVICE

Using the 2035 conditions analysis, the LOS was identified for each of the corridor intersections between County Street in New Bedford and Adams Street in Fairhaven. Table 4.4 summarizes the anticipated delay and LOS of each intersection in 2035. The only intersection along the Route 6 Corridor that currently experiences significant delay and an unacceptable LOS is the

Kempton Street/Mill Street and Purchase Street intersection (known locally as the "Octopus Intersection").

Table 4.4. Intersection Delay and LOS Summary, 2035 Condition

Intersection Name	AM Intersection Delay (seconds)	AM Intersection LOS	PM Intersection Delay (seconds)	PM Intersection LOS
Mill Street and Cottage Street	19.2	B	17.0	B
Kempton Street and Cottage Street	34.7	C	14.0	B
Mill Street and County Street	22.6	C	49.6	D
Kempton St and County Street	17.5	B	17.5	B
Kempton Street/Mill Street and Purchase Street ("Octopus Intersection")	87.7	F	112.5	F
Huttleston Avenue & Middle Street	9.8	A	11.6	B
Huttleston Avenue & Main Street	26.3	C	28.6	C
Huttleston Avenue & Adams Street	39.1	D	18.1	B

CORRIDOR VOLUME TO CAPACITY RATIOS/QUEUE LENGTHS

The volume/capacity (v/c) ratio represents the sufficiency of an intersection to accommodate the vehicle demand. A v/c ratio less than 0.85 generally indicates that adequate capacity is available and vehicles are not expected to experience significant queues and delays. As the v/c ratio approaches 1.0, traffic flow may become unstable, and delay and queuing conditions may occur. As shown in Table 4.5, although some ratios are greater than 0.85, none of the intersections are at or above 1.0, indicating that there is sufficient capacity in the corridor intersections to accommodate the future demand.

Table 4.5. Corridor Intersection Volume/Capacity Ratios, 2035 Condition

Intersection Name	AM Intersection V/C Ratio	PM Intersection V/C Ratio
Mill Street & Cottage Street	0.43	0.51
Kempton Street & Cottage Street	0.90	0.63
Mill Street & County Street	0.77	0.92
Kempton Street & County Street	0.69	0.76
Kempton Street/Mill Street & Purchase Street ("Octopus Intersection")	0.72	0.89
Huttleston Avenue & Middle Street	0.47	0.54
Huttleston Avenue & Main Street	0.65	0.66
Huttleston Avenue & Adams Street	0.82	0.64

Table 4.6 presents the queue lengths that would be experienced at each intersection along the Route 6 Corridor in the 2035 No Build Condition. As noted, these queue lengths are the same for the 2035 Build Condition.

Table 4.6. Corridor Intersection 50th and 95th Percentile Queue Lengths, 2035

Intersection Name	Link Name	Movement	AM 50th percentile queue (feet)	AM 95th percentile queue (feet)	PM 50th percentile queue (feet)	PM 95th percentile queue (feet)
Mill Street & Cottage Street	Mill Street	Westbound	122	161	114	179
Mill Street & Cottage Street	Cottage Street	Northbound	54	55	26	48
Mill Street & Cottage Street	Cottage Street	Southbound	49	80	38	85
Kempton Street & Cottage Street	Kempton Street	Eastbound Left	3	8	8	12
Kempton Street & Cottage Street	Kempton Street	Eastbound Through	207	240	128	156
Kempton Street & Cottage Street	Kempton Street	Eastbound Right	0	5	0	0
Kempton Street & Cottage Street	Cottage Street	Northbound	127	150	54	127
Kempton Street & Cottage Street	Cottage Street	Southbound	162	169	64	122
Mill Street & County Street	Mill Street	Westbound	147	195	155	225
Mill Street & County Street	County Street	Northbound Left	8	14	23	23
Mill Street & County Street	County Street	Northbound Through	49	67	175	203
Mill Street & County Street	County Street	Southbound	254	441	278	457
Kempton Street & County Street	Kempton Street	Eastbound Left	24	38	24	44
Kempton Street & County Street	Kempton Street	Eastbound	100	109	84	119
Kempton Street & County Street	County Street	Northbound	135	234	145	283
Kempton Street & County Street	County Street	Southbound	79	162	196	209
Kempton Street/Mill Street & Purchase Street	Kempton Street	Eastbound Left	245	404	378	580
Kempton Street/Mill Street & Purchase Street	Kempton Street	Eastbound	211	228	212	300
Kempton Street/Mill Street & Purchase Street	Mill Street	Westbound Left	374	525	365	574

Intersection Name	Link Name	Movement	AM 50th percentile queue (feet)	AM 95th percentile queue (feet)	PM 50th percentile queue (feet)	PM 95th percentile queue (feet)
Kempton Street/Mill Street & Purchase Street	Mill Street	Westbound Through	405	482	366	536
Kempton Street/Mill Street & Purchase Street	Mill Street	Westbound Right	119	183	96	129
Kempton Street/Mill Street & Purchase Street	Purchase Street	Northbound Left	102	156	209	262
Kempton Street/Mill Street & Purchase Street	Purchase Street	Northbound Through	145	168	260	328
Kempton Street/Mill Street & Purchase Street	Purchase Street	Northbound Right	0	32	40	104
Kempton Street/Mill Street & Purchase Street	Purchase Street	Southbound	281	360	491	626
Huttleston Avenue & Middle Street	Huttleston Ave	Eastbound	61	86	131	170
Huttleston Avenue & Middle Street	Huttleston Ave	Westbound	58	56	64	78
Huttleston Avenue & Middle Street	Middle Street	Northbound	62	109	84	131
Huttleston Avenue & Main Street	Huttleston Ave	Eastbound Left	43	56	93	136
Huttleston Avenue & Main Street	Huttleston Ave	Eastbound	87	61	81	68
Huttleston Avenue & Main Street	Huttleston Ave	Westbound Left	11	35	20	45
Huttleston Avenue & Main Street	Huttleston Ave	Westbound	165	149	167	146
Huttleston Avenue & Main Street	Main Street	Northbound	86	92	137	198
Huttleston Avenue & Main Street	Main Street	Southbound	132	142	156	279
Huttleston Avenue & Adams Street	Huttleston Ave	Eastbound	156	183	40	60
Huttleston Avenue & Adams Street	Huttleston Ave	Westbound	108	162	123	202
Huttleston Avenue & Adams Street	Adams Street	Northbound	106	191	96	151
Huttleston Avenue & Adams Street	Adams Street	Southbound	118	125	118	146

AVERAGE ROADWAY TRAVEL TIME/DELAY

Using the intersection capacity analysis prepared for the 2035 No Build Condition, the travel time along the Route 6 Corridor was prepared to better assess the future conditions when the bridge is open to vehicular traffic. These travel times were compared with the travel times experienced during the 2014 Existing Condition. This comparison in travel times between the 2014 Existing Condition and the 2035 No Build Condition is provided in Table 4.7.

Table 4.7. Route 6 Corridor Travel Times between Cottage Street and Adams Street

Direction	2014 Existing AM Peak Hour	2014 Existing PM Peak Hour	2035 Estimated AM Peak Hour	2035 Estimated PM Peak Hour
Eastbound	6.9 minutes	6.4 minutes	7.2 minutes	6.5 minutes
Westbound	8.2 minutes	6.9 minutes	8.9 minutes	7.5 minutes

As noted in Table 4.7, the travel times along the corridor are generally expected to increase over the 20-year period. This increased travel time in the 2035 No Build Condition, which is generally between seven and eight percent, or 30 to 35 seconds, longer than the 2014 Existing Condition. Some of these travel time increases may be offset by signal system improvements discussed in the short- and medium-term improvements analysis section later in this chapter.

The total travel delay times for eastbound and westbound traffic along the corridor that is due to intersection signal delay is included in Table 4.8. These intersection delay times can be contrasted with the average delay of 12.5 minutes that occurs once per hour when the bridge opens for vessel traffic.

Table 4.8. Route 6 Corridor Delay Due to Intersection Signals

Direction	2014 Existing AM Peak Hour	2014 Existing PM Peak Hour	2035 Estimated AM Peak Hour	2035 Estimated PM Peak Hour
Eastbound	3.0 minutes	2.6 minutes	3.4 minutes	2.6 minutes
Westbound	4.4 minutes	3.1 minutes	5.0 minutes	3.6 minutes

BICYCLE & PEDESTRIAN MOBILITY/CONNECTIVITY

The width of the existing swing span allows for five-foot-wide sidewalks on both the north and south sides and the roadway shoulders less than two feet in width. The rest of the corridor has a slightly wider right-of-way (ROW), but it is still not wide enough to accommodate five-foot-wide bike lanes. Consequently, bicyclists and pedestrians both use the sidewalks along the bridge corridor segment.

Most pedestrian/bicycle use of the bridge occurs on the southern sidewalk since this sidewalk directly connects to the New Bedford downtown and waterfront. A new pedestrian ramp was completed in 2014 as part of a new roadway ramp from northbound Route 18 to eastbound Route 6. Between the New Bedford and Fairhaven shorelines, pedestrian and bicycle connectivity is difficult due to a lack of secure crossings, ramps, and gaps in the sidewalk network.

Because of these access challenges and safety concerns, pedestrian and bicyclist use of the bridge is currently limited. During the peak hour counts conducted for the study, only one pedestrian was observed to walk the entire length of the bridge between New Bedford and Fairhaven. During the warmer months, it is understood that pedestrian and bicycle use is more frequent and increases during non-peak auto hours.

The No Build Alternative does not provide additional bridge width to support the addition of a continuous five-foot-wide bike lane along the corridor. The five-foot-wide sidewalk will remain on each side. A roadway restriping is planned for completion in 2015 to narrow the traffic lanes from 12 to 11-feet-wide, which will allow for slightly wider shoulders along the entire bridge corridor. However, it will not be sufficient to permit a dedicated bike lane along the swing span.

4.2.3 Safety

Improving roadway, pedestrian, bicycle, and marine safety, reducing conflicts between transportation modes, and increasing emergency vehicle access are important considerations for evaluating the long-term alternatives. As described in this section, the replacement of the superstructure would not result in any changes from the existing conditions with regard to conformance to AASHTO and MassDOT standards, delay to emergency vehicle or marine access, or impact to high volume bicycle and pedestrian locations. The concerns related to safe vessel navigation through the bridge would remain as a concern and a significant constraint to New Bedford Harbor.

CONFORMANCE WITH AASHTO AND MASSDOT STANDARDS

For a bridge and approach roadway to be safe for vehicular traffic, it must be geometrically adequate. This consideration takes into account the number of lanes, lane and shoulder widths, approach roadway widths, horizontal clearances to roadside obstacles, stopping sight distances, vertical clearances and more. The standards for these criteria are identified in the AASHTO *Policy on Geometric Design of Highways and Streets* and the MassDOT *Project Development and Design Guidebook* (2006). The No Build Alternative would not result in any changes from the existing condition with regard to conformance to AASHTO and MassDOT standards.

DELAY TO EMERGENCY VEHICLE ACCESS

Both New Bedford and Fairhaven provide fire and emergency services to their respective municipalities. In case of bridge closure, Pope's Island can receive service from Fairhaven via the East Bridge. St. Luke's Hospital in New Bedford is the only facility in the two municipalities that provides emergency services. Bridge closures can affect Emergency Medical Services (EMS) access to the hospital from Fairhaven. The impact of access or delay for emergency vehicles will not change from the current condition with the proposed project.

IMPACT TO HIGH VOLUME BICYCLE AND PEDESTRIAN LOCATIONS

A sidewalk runs along the entire length of the north and south sides of the Route 6 Corridor between MacArthur Drive in New Bedford and Middle Street in Fairhaven. When the current roadway construction is completed in 2015, the roadway shoulders will be widened by reducing the vehicular travel lane width. The existing swing span cross section and width will remain the same under the No Build Alternative. Consequently, five-foot-wide dedicated bike lanes cannot be provided and bicyclists will continue to use the sidewalks. However, since high pedestrian or bicycle volumes are not seen on the bridge and are not anticipated in the future, it is anticipated that there will be an impact to high volume bicycle or pedestrian locations.

IMPACT TO SAFE NAVIGATION

Due to the existing navigational width of the channels at the existing bridge, safe vessel navigation through the bridge is a serious concern and a significant constraint to the North Harbor. Concerns for safe navigation have resulted in vessel limitations, which have resulted in delays and additional costs for commercial vessels.

Navigation through the bridges 94- and 95-foot-wide channels is the primary concern for large commercial vessels. These vessels generally employ harbor tugs for ship assist when maneuvering through the harbor and the bridge. Even with the tugs, limitations are still in place for transiting through the bridge. These include wind speed, visibility, and daylight.

- Wind speed is the primary concern that limits vessels ability to pass through the bridge. In all cases, if the wind exceeds 25 knots, no large vessel will transit the bridge. If the vessel is over 400 feet in length, this may be reduced to as little as 12 knots given the direction and based on the pilot's discretion.
- No vessel will transit through the bridge if the visibility is less than one nautical mile. Although large vessels do not enter the harbor though the hurricane barrier if visibility is limited, changes in visibility can occur rapidly in the harbor due to fog or heavy precipitation.
- Vessels greater than 500 feet in length or over 80 feet in width transit through the bridge and hurricane barrier in daylight only.

When transiting the current bridge, there is limited room for larger vessels to maneuver, especially north of the bridge between Fish Island and Pope's Island. Vessels approach slowly and then increase speed as they enter the bridge opening to ensure that they can exercise better control of the vessel through the passage. The limited maneuvering space on either side of the bridge is complicated by the fact that typically ships approach the bridge on an angle due to slow approach speeds. This angle further reduces any free space between the vessel and the bridge as the vessel is moving through. The swing span's central pivot point, associated piers, and fendering system are located approximately in the center of the federal deep-water channel. This makes the bridge, in the perspective of the pilots, the most vulnerable navigation safety area in the harbor.

When larger ships head northbound through the bridge, limited space is available for stopping or maneuvering once they pass the bridge. Generally, two tugs are employed; one at the bow and one at the stern, but only one can assist once the vessel is in the bridge opening due to the width of the channel. The forward tug goes through the bridge first and can come back alongside once the bow clears. Proceeding northbound, once the vessel passes through the bridge and enters the basin, it must slow and stop before being maneuvered into a berth.

Generally, vessels do not require tugs on transiting southbound. When departing southbound, the vessel leaves the berth and turns in the basin in a manner that allows it to line up with the west channel that is used most of the time. Once lined up, it transits the opening and maintains its alignment with the federal deep-water channel.

The No Build Alternative will not result in any improvements to safe navigation through the bridge. The channel widths and limited maneuverable space in the North Harbor will not change because of the project and the bridge will continue to be a significant constraint to New Bedford Harbor.

DELAY TO EMERGENCY MARINE ACCESS

Currently, the swing span impedes emergency vessel access in cases where there is an emergency in the North Harbor. Both New Bedford and Fairhaven dock their emergency vessels south of the bridge. The bridge must open to allow municipal police, fire and rescue, harbormaster, or other emergency response vessels to transit the bridge. With the exception of one fireboat, the emergency vessels need at least 14 feet of clearance to allow passage without requiring the bridge to open. The No Build Alternative will not increase the vertical clearance from six feet and the bridge will need to open for all emergency vessels. The potential delay for emergency marine response will remain.

4.2.4 Environment

Since the No Build Alternative will not involve a substantial amount of in-water construction, the potential for impacts to the natural environment are limited. It is anticipated that the project would not result in any adverse effects as compared to the current condition. The following sections provide a screening-level assessment, therefore additional and more in-depth analyses of resource impacts would be required, per the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA), as the designs for the bridge progress.

IMPACT TO COASTAL RESOURCES

Coastal Zone Impacts

The New Bedford-Fairhaven Bridge is located within the designated coastal zone of the Commonwealth of Massachusetts. While no impacts are anticipated to the coastal zone, the project may be subject to a federal consistency review to ensure that the proposed project would be consistent with the enforceable policies of the federally approved coastal management program of the Commonwealth.

Floodplains

The current bridge is located within the 100-year floodplain. Flooding and construction within the 100-year floodplain is under the jurisdiction of the Massachusetts Office of Coastal Zone Management (CZM). Since the No Build Alternative does not require substantial in-water construction or construction on the approaches, it is anticipated that potential impacts to floodplains would be minimal. However, coordination with CZM may be needed in future phases of the project to fully identify the extent of potential impacts to the 100-year floodplains and the applicability of coastal hazard policies.

Hazardous and Contaminated Materials

New Bedford-Fairhaven Harbor has been designated as a Superfund Site and is currently undergoing an extensive clean-up effort by the U.S. Environmental Protection Agency (EPA). Since the No Build Alternative would not require a substantial amount of in-water construction work, this alternative has limited potential to result in impacts from the existing contaminated harbor sediments. However, as any designs for the bridge progress, coordination would be undertaken with the EPA and the MassDEP to determine the amount of disturbance anticipated during construction, options for mitigation and minimization, and for the appropriate disposal of the contaminated sediments, as needed.

IMPACT TO WETLAND RESOURCES

A small area of rocky intertidal wetlands is located on the western shore of Pope's Island. Temporary disturbance resulting from the construction of the No Build Alternative may potentially affect this wetland type. Additional field verification of this wetland type, as well as consultation with the U.S. Army Corps of Engineers (USACE) and MassDEP, would be needed in future phases of this project to determine the extent of this resource.

Since the project does not require substantial in-water construction, the No Build Alternative has limited potential to impact water quality from the disturbance and removal of contaminated sediments from New Bedford Harbor during construction. However, coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination.

Proper erosion and sedimentation controls, as well as stormwater pollution prevention best management practices (BMPs), would be implemented during the construction phase to prevent or avoid any potential impacts to the wetlands and aquatic species known to reside within them. Examples of BMPs include silt fencing, biotubes, and regulated construction entrances. Consultation with USACE and MassDEP regarding avoidance and minimization of potential impacts as well as permitting requirements should be undertaken during any future phases of this project.

As project development progresses, special consideration should be given to the location of construction staging areas on Pope's Island. Coastal bank bluff and sea cliff wetlands form the southern shores of Pope's Island and the placement of construction staging areas within or adjacent to these wetlands should be avoided.

IMPACT TO NATURAL RESOURCES

The No Build Alternative would not result in any impacts to Areas of Critical Environmental Concern (ACEC), prime farmland soils, or aquifers. The No Build Alternative has minimal potential for temporary impacts to water quality, shellfish and fish habitat, and priority habitats because of construction.

Water Quality

The proposed bridge rehabilitation has limited potential to impact water quality since the amount of in-water work is minimal in the No Build Alternative. This alternative does not require disturbance or removal of contaminated sediments from New Bedford-Fairhaven Harbor during construction. However, coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination. Additionally, proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to water quality from construction activities.

Shellfish and Fish Habitat

The No Build Alternative has limited potential to result in any impacts to shellfish and fish habitats. However, since New Bedford Harbor has been designed as a shellfish growing area, coordination may be needed with MassDEP to ensure that construction activities do not disrupt active shellfish spawning grounds. Proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to shellfish and fish habitats from construction activities.

Although the consumption of fish and shellfish caught in the New Bedford Inner Harbor is regulated by the Massachusetts Department of Public Health (MDPH), consultation with the National Oceanographic Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) should be undertaken during future phases of this project to determine the presence of Essential Fish Habitats (EFH) within New Bedford-Fairhaven Harbor.

Priority Habitats

The No Build Alternative will not affect priority plant or animal habitats. However, additional field verification or consultation with the U.S. Fish and Wildlife Service (USFWS) and MassDEP may be required in future phases of the project to verify the presence of state and federally listed plant and animal species and habitats.

IMPACTS TO AIR QUALITY AND GREENHOUSE GASES FROM IDLING VEHICLES

None of the long-term alternatives, including the No Build Alternative, would increase traffic volumes the New Bedford-Fairhaven Bridge as compared to the 2035 No Build Condition described in Chapter 2. The number of bridge openings would remain the same. Consequently, none of the long-build alternatives has the potential to worsen air quality compared to the 2035 No Build Condition. However, in future phases of the project, a formal air quality evaluation (microscale or mesoscale) may be required to determine the proposed project's impacts as compared to the National Ambient Air Quality Standards (NAAQS).

Since the No Build Alternative does not include additional bicycle and pedestrian facilities along the Route 6 Corridor, there is only minimal potential for localized air quality benefits. The No Build Alternative does not include these facilities and the potential to shift some motorists to non-motorized modes and reduce the number of idling cars at bridge openings is lower than the build alternatives that include pedestrian and bicycle facilities.

Potential temporary impacts to air quality would be anticipated from construction activities. BMPs would be implemented during construction to minimize vehicle emissions and manage fugitive dust. Typical air quality mitigation measures implemented during construction could include dust suppression and control methods to minimize fugitive dust on dry and windy days.

IMPACTS FROM NOISE

Since traffic volumes are not anticipated to increase substantially over existing levels, the No Build Alternative is not anticipated to result in noise impacts to nearby noise-sensitive receptors. However, a formal noise assessment in compliance with the Federal Highway Administration (FHWA) would be required in any future phases of this project.

Potential temporary noise impacts would result from construction activities and the operation of construction equipment. BMPs would be implemented during construction to mitigate potential noise impacts (particularly during non-daytime hours).

4.2.5 Land Use & Economic Development

The No Build Alternative would maintain the existing constraints being experienced in New Bedford Harbor related cargo delay and business development in the North Harbor.

NUMBER/VALUE OF BUSINESSES AND JOBS PERMANENTLY IMPACTED

In the No Build Alternative, the existing swing span will be rehabilitated and no additional ROW acquisition will be required. The operation of the bridge will not change and would not functionally affect the operation of area businesses. The No Build Alternative would not result in the reduction of the number of jobs. With the absence of physical ROW changes and business operational impacts, no business or related property impacts or acquisition is anticipated due to physical or functional impacts.

SHIPPER COST SAVINGS

Since the No Build Alternative maintains the existing swing span and the existing constraints will remain, no shipper cost savings are anticipated. The same number of ships would experience delays transiting through the bridge and no cost savings would be achieved.

4.2.6 Community

The impacts to community resources, such as open space, recreational areas, or historic/cultural resources, were evaluated for the No Build Alternative. Additionally, access to businesses along the corridor and impacts to Environmental (EJ) populations, and visual impacts were also evaluated.

IMPACT TO PROTECTED AND RECREATIONAL OPEN SPACE

The No Build Alternative would not result in any impacts to protected and/or recreational open space. However, an evaluation of publicly owned parklands, per Section 4(f) of the Department of Transportation Act of 1966, may be required for any future phases of this project.

As the project development phase continues and the designs for the bridge progresses, special consideration should be given to the location of construction staging areas. Marine Park on Pope's Island is owned and operated by the City of New Bedford and occupies the southern half of the island, but should not be used for construction staging.

IMPACT TO CULTURAL/HISTORIC/ARCHAEOLOGICAL RESOURCES

Under the No Build Alternative, the superstructure of the middle bridge's swing span of the National Register-eligible New Bedford-Fairhaven Bridge would be replaced. The loss of the original superstructure could diminish the integrity of this historic property.

The replacement of the bridge superstructure should not result in indirect visual effects to historic properties that lie within the larger study area. A portion of the through truss of the existing swing span is visible as a component of the urban/industrial landscape from both the Schooner Ernestina, located on the New Bedford waterfront, and buildings that lie along the eastern edge of the New Bedford Historic District (see Figure 2.11). Both the Schooner Ernestina and the New Bedford Historic District are National Historic Landmarks. The No Build Alternative would not alter the visual setting of the New Bedford Historic District and the Schooner Ernestina.

Although the No Build Alternative maintains the existing bridge, the replacement of a large amount of original structural members could result in impacts that would require consultation with the Massachusetts Historical Commission (MHC), the State Historic Preservation Office (SHPO). Once the preferred alternative has been selected, FHWA will need to initiate consultation with the MHC in accordance with Section 106 of the National Historic Preservation Act. Consultation should also be undertaken with the New Bedford and Fairhaven Historical Commissions. Through this consultation, additional historic properties that may be eligible for, but are not yet listed in, the National Register of Historic Places will be identified. The potential for effects to archeological resources will also be determined. FHWA, working together with the MHC, will seek ways to avoid, minimize, or mitigate adverse effects beyond the Historic American Engineering Record (HAER) documentation that has already been completed. In addition to consultation under Section 106, the preparation of a programmatic

4(f) evaluation, in compliance with the U.S. Department of Transportation Act of 1966, will be required.

IMPACT TO BUSINESS ACCESS

The parcels surrounding the approaches to the middle bridge include the following businesses:

- Bridge Shoppes shopping center;
- Captain Leroy's marina;
- Maritime Terminals facility;
- AGM Marine Contractors, Inc.; and
- Tucker Roy Marin Towing and Salvage.

The No Build Alternative does not include any modifications to the bridge approaches and utilizes the existing footprint. The horizontal alignment of the road and access to abutting properties will remain the same.

IMPACT TO ENVIRONMENTAL JUSTICE POPULATIONS

The locations of Environmental Justice (EJ) populations were identified in Chapter 2. Some EJ populations reside in neighborhoods that abut or are adjacent to the New Bedford-Fairhaven Bridge. Residential clusters of EJ populations reside at the western edge of the local study area in New Bedford and EJ populations (low-income) also reside throughout the local study area within Fairhaven. Consequently, an evaluation of the potential for disproportionately high and adverse human health or environmental effects of the project alternatives on minority populations and low-income populations, per *Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, would be required in future phases of the project to comply with NEPA and MEPA.

The greatest potential for impacts to EJ populations would occur during construction. Under the No Build Alternative, the construction phase would be approximately 18 months. The bridge would be closed to vehicular, bicycle, and pedestrian traffic for two weeks. No transit service currently operates across the bridge. The No Build Alternative also has the potential to result in other temporary construction impacts to the EJ populations located in close proximity to the proposed bridge. Potential impacts could include noise, glare, fumes, and dust from construction equipment as well as changes in traffic patterns and access to businesses due to the movement of construction vehicles. Potential construction period impacts would be mitigated with BMPs for construction activities including those used to minimize dust, noise, maintenance, and protection of traffic plans, and limiting the hours of construction. Further analyses under NEPA and MEPA would be required to determine if construction-related impacts would be disproportionately higher on low-income and minority populations.

The No Build Alternative, along with all of the long-term build alternatives, has the same proportion of impacts to EJ populations compared to non-EJ populations.

VISUAL IMPACTS

Under the No Build Alternative, the existing superstructure will be rebuilt to match the existing bridge. Both swing spans will be approximately 55 feet above the roadway surface and 70 feet above MHW. Consequently, this alternative will not result in any visual impacts.

4.2.7 Alternative Feasibility

The identification of the costs, construction phase impacts, and permanent ROW impacts provides a critical way to evaluate the feasibility of an alternative. This section describes the capital costs, operating and maintenance costs, the construction methodology, a description of impacts to marine and vehicular traffic during construction, and permanent impacts to adjoining properties or businesses that result from the No Build Alternative.

CAPITAL COST

The estimated cost for the No Build Alternative is $45 million. This capital cost would include bridge design and permitting, removal of the existing swing truss structure, and replacement with a newly constructed structure. Limits of construction would be generally limited to the 289-foot length of the existing swing span.

It is assumed that dredging and disturbance of the harbor sediments would not be required as part of the project and no changes to the fendering system would be provided. A more detailed cost estimate would be developed as additional information regarding subsurface conditions, bridge specifications, and design details are developed through the project development process.

OPERATING AND MAINTENANCE COSTS

Upon completion of construction, the No Build Alternative will require both routine maintenance and daily operating costs. Table 4.9 provides the estimated annual costs required to operate and maintain the bridge, which is the second lowest of all of the long-term alternatives. The No Build Alternative has only one mechanical element, which lowers the costs for electricity and lubrication compared to the double-leaf long-term alternatives.

Table 4.9. No Build Alternative: Annual Operating and Maintenance Costs

Operating Costs	Type	Annual Cost (2015$)
Operating Cost	Electricity utility	$ 50,000
Operating Cost	Stand by generator	$ 2,600
Operating Cost	Bridge operators	$300,000
Routine Maintenance	Monthly bridge lubrication	$ 14,400
Routine Maintenance	Replace lamps	$ 1,500
Routine Maintenance	Replace gate arms	$ 7,000
Routine Maintenance	Miscellaneous minor repairs	$ 20,000
Routine Maintenance	Guard rail repairs	$ 20,000
	TOTAL	$ 415,500

In addition to the annual operating and maintenance costs identified above, the newly replaced swing bridge will require major repairs to be conducted on a regular basis to maintain the bridge in a state of good repair and ensure its ongoing utility. The schedule of major repairs included in Table 4.10 is an estimate of repairs that is typical for new swing bridges in similar environments. Over a 50-year span, it should be anticipated that approximately $10.4 million worth of repairs (in 2015 dollars) will be required.

Table 4.10. No Build Alternative: Schedule of Major Repairs

Year	Work Performed	Cost (2015$)
5	Superstructure strengthening/miscellaneous repairs	$2,500,000
10	Fender repairs	$ 250,000
25	Fender repair Control House repairs	$1,250,000 $ 100,000
30	Deck repairs	$ 250,000
35	Minor mechanical repairs Electrical Control repaired Substructure repairs	$ 1,000,000 $ 1,500,000 $3,000,000
40	Fender repairs	$ 250,000
45	Deck repairs	$ 250,000
	TOTAL	$10,350,000

CONSTRUCTION PHASE TRANSPORTATION IMPACTS

The construction phase for the No Build Alternative is 18 months, which is shorter than all of the build alternatives by at least eight months. This alternative would allow for keeping two lanes open for most of the time to vehicular traffic. A two-week long roadway closure would be required in the 12th month of construction. One of the two existing navigational channels would be open for most of the construction duration. Two navigational closures would be required during a two separate long-weekends, which would occur in the 12th month of construction.

CONSTRUCTION PHASE IMPACTS TO ABUTTING LAND OWNERS/BUSINESSES

The construction phase of each long-term alternative has the potential impact to area businesses and property owners due to the change in access during that period. The construction phase of the No Build Alternative is 18 months. While at least two vehicular lanes would be open for most of the construction period, this alternative requires a two-week roadway closure and two marine closures over long weekends that would result in some impacts to area businesses. Compared to the build alternatives, the No Build Alternative's shorter construction duration and ability to maintain at least two vehicular lanes for most of the construction period would limit any significant business impacts.

4.3 ALTERNATIVE 1: VERTICAL LIFT BRIDGE

This section provides an evaluation of Alternative 1: Vertical Lift Bridge consistent with the evaluation criteria established at the initiation of the study. The evaluation criteria are specific measures of effectiveness used to assess benefits and impacts of each alternative.

Alternative 1 is a vertical lift bridge that provides 270 feet of navigational clearance and up to 135 feet of air draft. As shown in Figures 4.2 and 4.3, this alternative has two towers that are used to house the mechanical equipment used to raise and lower the bridge structure. Figures 4.2 and 4.3 provide simulated renderings of what Alternative 1 would look like if standing at Captain Leroy's marina on Pope's Island. Figure 4.2 shows the bridge in the closed position (open for vehicular traffic). Figure 4.3 shows the bridge in the open position (closed for vehicular traffic).

Figure 4.2. Alternative 1: Vertical Lift Bridge in Closed Position

Figure 4.3. Alternative 1: Rendering of Vertical Lift Bridge in Open Position

4.3.1 Bridge Operations

While the number and duration of bridge openings remains the same in Alternative as the current condition and the No Build Alternative, this alternative offers increased vertical clearance in the closed position and horizontal navigational clearance almost three times as wide as the current condition.

MINUTES PER BRIDGE CLOSURE

The opening sequence of the bridge in all of the long-term alternatives, including Alternative 1, would continue to follow the AASHTO recommendation that requires approximately four minutes to open and an additional four minutes to close. The average time to open and close the bridge will continue to vary based on the marine traffic transit time and the time required to clear pedestrians and vehicles from the movable span before it can open to marine traffic. The minutes per bridge closure in Alternative 1 is the same as the current condition.

For this alternative, it is possible that the moveable section of the bridge may not be lifted to the full height each time the bridge is opened. A policy could be established to allow the bridge operator to have the discretion to open the bridge to only the height needed to allow the vessels queued to go through the opening. Although this has the potential to sAvenue60 to 90 seconds (which represents about five percent on an average bridge opening), it would only occur when the bridge operator is confident that no tall vessels are planning to transit the bridge at that time.

FEET OF VERTICAL CLEARANCE (OPEN & CLOSED)

The Alternative 1 bridge would be designed to have a vertical clearance of 14 feet above MHW in the closed position and between 110 to 135 feet above MHW in the open position. Although 110 feet of vertical clearance is anticipated to be sufficient for the vessel types that currently come into the North Harbor, there may be cases where additional vertical clearance is necessary. Since 135 feet of vertical clearance has been the standard for most bridges on the East Coast that cross over waterways with major commercial vessel traffic, for this analysis, it is assumed that this would be the vertical clearance for Alternative 1. The No Build Alternative and the bascule alternatives provide unlimited air draft for vessels.

FEET OF HORIZONTAL CLEARANCE

The Alternative 1 bridge would include approximately 270 feet of horizontal navigational clearance. The bridge would be aligned so that the new pier towers are approximately in the same location as the east and west abutments of the existing swing span.

NUMBER OF DAILY BRIDGE OPENINGS

As described in the No Build Alternative, the bridge currently operates on a fixed schedule each day. For all of the long-term alternatives, including Alternative 1, the schedule and number of daily bridge openings are expected to stay the same.

LONG-TERM RELIABILITY RISK

Since each moveable bridge includes a complex interaction of mechanical, electrical, and structural components, there is an inherent risk in a moveable bridge that one of these systems will not operate as designed on any particular day and result in the inability for the bridge to open or close. Some moveable bridge types are at greater risk of inoperability than others due to the nature of their design and the conditions and environment that they operate within. As inoperability of a bridge for a period of time results in community and economic impacts, the risk associated with bridge reliability in the long-term was assessed. This included a general assessment of existing bridges of the type and size under consideration in conditions similar to that of New Bedford Harbor and their ability to remain reliable throughout the life span of the bridge. As noted, all moveable bridges are complex and have some long-term reliability risk. The span width and length of a new vertical lift bridge (Alternative 1) when operating in the marine costal environment of New Bedford Harbor is estimated to have a medium level of risk. It is likely that even with regular maintenance, the bridge would experience some periods of unanticipated inoperability similar to any moveable bridge in the same location.

4.3.2 Transportation Impacts/Mobility Analysis

The evaluation and assessment of mobility along the corridor between County Street in New Bedford and Adams Street in Fairhaven is an important component of this study. Like of the long-term alternatives, Alternative 1 will not change vehicular traffic along the corridor. Unlike the No Build Alternative, Alternative 1 will provide additional pedestrian and bicycle facilities.

CORRIDOR INTERSECTION LOS, V/C RATIO, QUEUE LENGTHS & ROADWAY TRAVEL TIME/DELAY

As noted in the No Build Alternative analysis, none of the long-term alternatives, including Alternative 1, will change result in changes to vehicular traffic along the corridor as compared to the 2035 No Build Condition described in Chapter 2. Each of the long-term alternatives being considered will result in the same number of bridge openings and the bridge will, on average, be open for the same duration. Therefore, the mobility analysis described previously in Section 4.2.2 related to the No Build Alternative is consistent with the results of intersection LOS, volume to capacity ratio, queue lengths, and travel time and delay analysis for Alternative 1.

BICYCLE & PEDESTRIAN MOBILITY/CONNECTIVITY

The width of the existing swing span allows for five-foot-wide sidewalks on both the north and south sides and the roadway shoulders less than two feet in width. The rest of the corridor has a slightly wider right-of-way (ROW), but it is still not wide enough to accommodate five-foot-wide bike lanes. Consequently, bicyclists and pedestrians both use the sidewalks along the bridge corridor segment.

Most pedestrian/bicycle use of the bridge occurs on the southern sidewalk since this sidewalk directly connects to the New Bedford downtown and waterfront. A new pedestrian ramp was completed in 2014 as part of a new roadway ramp from northbound Route 18 to eastbound Route 6. Between the New Bedford and Fairhaven shorelines, pedestrian and bicycle connectivity is difficult due to a lack of secure crossings, ramps, and gaps in the sidewalk network.

Because of these access challenges and safety concerns, pedestrian and bicyclist use of the bridge is currently limited. During the peak hour counts conducted for the study, only one pedestrian was observed to walk the entire length of the bridge between New Bedford and Fairhaven. During the warmer months, it is understood that pedestrian and bicycle use is more frequent and increases during non-peak auto hours.

Like all of the build alternatives, Alternative 1 allows for a wider bridge with a 64-foot-wide ROW. This bridge width allows for the construction of four 11-foot-wide vehicular travel lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. However, while Alternative 1 provides improved facilities compared to the No Build Alternative, the delay for bicyclists and pedestrians will not change as it is controlled by the frequency and duration of bridge openings, which will not change from the current condition.

4.3.3 Safety

Improving roadway, pedestrian, bicycle, and marine safety, reducing conflicts between transportation modes, and increasing emergency vehicle access are important considerations for evaluating the long-term alternatives. This section provides an overview of the key safety concerns that will be addressed by Alternative 1.

CONFORMANCE WITH AASHTO AND MASSDOT STANDARDS

For a bridge and approach roadway to be safe for vehicular traffic, it must be geometrically adequate. This consideration takes into account the number of lanes, lane and shoulder widths, approach roadway widths, horizontal clearances to roadside obstacles, stopping sight distances, vertical clearances and more. The standards for these criteria are identified in the AASHTO *Policy on Geometric Design of Highways and Streets* and the MassDOT *Project Development and Design Guidebook* (2006). Alternative 1 will conform to these standards with no known variance required.

DELAY TO EMERGENCY VEHICLE ACCESS

Both New Bedford and Fairhaven provide fire and emergency services to their respective municipalities. In case of bridge closure, Pope's Island can receive service from Fairhaven via the East Bridge. St. Luke's Hospital in New Bedford is the only facility in the two municipalities that provides emergency services. Bridge closures can affect Emergency Medical Services (EMS) access to the hospital from Fairhaven. Alternative 1 will not affect the level of access or potential for delay of emergency vehicles compared to the No Build Alternative.

IMPACT TO HIGH VOLUME BICYCLE AND PEDESTRIAN LOCATIONS

A sidewalk runs along the entire length of the north and south sides of the Route 6 Corridor between MacArthur Drive in New Bedford and Middle Street in Fairhaven. When the current roadway construction is completed in 2015, the roadway shoulders will be widened by reducing the vehicular travel lane width. In Alternative 1, the new bridge cross section will include both widened roadway shoulders and sidewalks. However, even though Alternative 1 provides additional pedestrian and bicycle facilities, high pedestrian or bicycle volumes are not seen on the bridge and are not anticipated in the future. Alternative 1 will have no impact to high volume bicycle or pedestrian locations.

IMPACT TO SAFE NAVIGATION

Due to the existing navigational width of the channels at the existing bridge, safe vessel navigation through the bridge is a serious concern and a significant constraint to the North Harbor. Concerns for safe navigation have resulted in vessel limitations, which have resulted in delays and additional costs for commercial vessels.

Navigation through the bridges 94- and 95-foot-wide channels is the primary concern for large commercial vessels. These vessels generally employ harbor tugs for ship assist when maneuvering through the harbor and the bridge. Even with the tugs, limitations are still in place for transiting through the bridge. These include wind speed, visibility, and daylight.

- Wind speed is the primary concern that limits vessels ability to pass through the bridge. In all cases, if the wind exceeds 25 knots, no large vessel will transit the bridge. If the vessel is over 400 feet in length, this may be reduced to as little as 12 knots given the direction and based on the pilot's discretion.
- No vessel will transit through the bridge if the visibility is less than one nautical mile. Although large vessels do not enter the harbor though the hurricane barrier if visibility is limited, changes in visibility can occur rapidly in the harbor due to fog or heavy precipitation.
- Vessels greater than 500 feet in length or over 80 feet in width transit through the bridge and hurricane barrier in daylight only.

When transiting the current bridge, there is limited room for larger vessels to maneuver, especially north of the bridge between Fish Island and Pope's Island. Vessels approach slowly and then increase speed as they enter the bridge opening to ensure that they can exercise better control of the vessel through the passage. The limited maneuvering space on either side of the bridge is complicated by the fact that typically ships approach the bridge on an angle due to slow approach speeds. This angle further reduces any free space between the vessel and the bridge as the vessel is moving through. The swing span's central pivot point, associated piers, and fendering system are located approximately in the center of the federal deep-water channel. This makes the bridge, in the perspective of the pilots, the most vulnerable navigation safety area in the harbor.

When larger ships head northbound through the bridge, limited space is available for stopping or maneuvering once they pass the bridge. Generally, two tugs are employed; one at the bow and one at the stern, but only one can assist once the vessel is in the bridge opening due to the width of the channel. The forward tug goes through the bridge first and can come back alongside once the bow clears. Proceeding northbound, once the vessel passes through the bridge and enters the basin, it must slow and stop before being maneuvered into a berth.

Generally, vessels do not require tugs on transiting southbound. When departing southbound, the vessel leaves the berth and turns in the basin in a manner that allows it to line up with the west channel that is used most of the time. Once lined up, it transits the opening and maintains its alignment with the federal deep-water channel.

While the No Build Alternative does not provide any change from the existing condition, Alternative 1 will result in significant improvements to safe navigation through the bridge. The 270 feet of horizontal clearance would mitigate many of the safe navigation concerns, most notably the wind restriction, which has a significant impact on vessel delay. The wider clearance would allow for full tug assistance throughout the bridge transit and would also minimize the impact of the limited maneuverable space in the North Harbor, which will not change as a result of the project.

DELAY TO EMERGENCY MARINE ACCESS

Currently, the swing span impedes emergency vessel access in cases where there is an emergency in the North Harbor since the bridge must open to allow municipal police, fire and rescue, harbormaster, or other emergency response vessels to transit the bridge.
The design of Alternative 1 allows for a vertical clearance of 14 feet in the down (closed) position. This is sufficient clearance for all but the largest emergency response vessels to fit under the bridge without the need to wait for a bridge opening. This would eliminate most of the delay to emergency response currently experienced due to the bridge.

4.3.4 Environment

The following section presents the potential for impacts to the natural environment from Alternative 1. Compared to the No Build Alternative, Alternative 1 has more potential to impact coastal, wetland, and natural resources due to the required in-water construction. The following sections provide a screening-level assessment, therefore additional and more in-depth analyses of resource impacts would be required, per the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA), as the designs for the bridge progress.

IMPACT TO COASTAL RESOURCES

Coastal Zone Impacts

The New Bedford-Fairhaven Bridge is located within the designated coastal zone of the Commonwealth of Massachusetts; therefore, this project may be subject to a federal consistency review to ensure that the proposed project would be consistent with the enforceable policies of the federally approved coastal management program of the Commonwealth.

The construction required to raise the elevation of the approach on Fish Island under Alternative 1 has the potential to affect Chapter 91 Tidelands located on the eastern side of the island. A Chapter 91 Waterways authorization from the Massachusetts Department of Environmental Protection (MassDEP) may be required for the construction of new bridge structure and retaining walls between the sidewalk and properties on Fish Island.

Within its policy documents, the Massachusetts Office of Coastal Zone Management (CZM) strongly encourages early coordination with the agency to determine the appropriate level of coastal review that would be required for projects. Coordination with CZM should be undertaken during any future NEPA and MEPA phases of the project.

Floodplains

The proposed bridge would be located within the 100-year floodplain. Alternative 1 would require the construction of permanent foundations for the towers to be constructed within the water, potentially affecting the 100-year floodplain and flood levels within this area. As the design for the bridge progresses, there is the opportunity to limit the size of the foundations, thereby minimizing impacts. Flooding and construction within the 100-year floodplain is under the jurisdiction of CZM; therefore, coordination with CZM would be needed in future phases of the project to determine the extent of potential impacts to the 100-year floodplain and the applicability of coastal hazard policies to this project.

Hazardous and Contaminated Materials

New Bedford-Fairhaven Harbor has been designated as a Superfund Site and is currently undergoing an extensive clean-up effort by the EPA. Alternative 1 would require a substantial amount of in-water construction work. As part of the construction, contaminated soil/sediment from New Bedford-Fairhaven Harbor would need to be removed so that new foundations for the bridge towers could be constructed. In-water soil/sediment disturbance would also be expected from the removal of the existing swing span center pier structure. Therefore, Alternative 1 has the potential to result in impacts from the existing contaminated harbor sediments.

As any designs for the bridge progress, coordination would be undertaken with the EPA and the MassDEP to determine the amount of disturbance anticipated during construction, options for mitigation and minimization, and for the appropriate disposal of the contaminated sediments.

IMPACT TO WETLAND RESOURCES

A small area of rocky intertidal wetlands is located on the western shore of Pope's Island. Temporary disturbance resulting from the construction of Alternative 1 may potentially affect this wetland type. Additional field verification of this wetland type, as well as consultation with the USACE and MassDEP, would be needed in future phases of this project to determine the extent of this resource.

Potential impacts to water quality may occur from the disturbance and removal of contaminated sediments from New Bedford-Fairhaven Harbor during construction. Coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination.

Proper erosion and sedimentation controls, as well as stormwater pollution prevention best management practices (BMPs), would be implemented during the construction phase to prevent or avoid any potential impacts to the wetlands and aquatic species known to reside within them. Examples of BMPs include silt fencing, biotubes, and regulated construction entrances. Consultation with USACE and MassDEP regarding avoidance and minimization of potential impacts as well as permitting requirements should be undertaken during any future phases of this project.

As project development progresses, special consideration should be given to the location of construction staging areas on Pope's Island. Coastal bank bluff and sea cliff wetlands form the southern shores of Pope's Island and the placement of construction staging areas within or adjacent to these wetlands should be avoided.

IMPACT TO NATURAL RESOURCES

Alternative 1 would not result in any impacts to Areas of Critical Environmental Concern (ACEC), prime farmland soils, or aquifers. Alternative 1 has the potential for temporary impacts to water quality, shellfish and fish habitat, and priority habitats as a result of construction.

Water Quality

Potential temporary impacts may be anticipated to water quality from the construction of the proposed bridge. Potential impacts to water quality from the in-water soil/sediment disturbance from the removal of the existing swing span center pier structure would be the same as the other build alternatives, but greater than the No Build Alternative.

Coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination. Additionally, proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to water quality from construction activities.

Shellfish and Fish Habitat

Alternative 1 has the potential to result in temporary impacts to shellfish and fish habitats from the construction of the proposed bridge. Since New Bedford Harbor has been designed as a shellfish growing area, coordination may be needed with MassDEP to ensure that construction activities do not disrupt active shellfish spawning grounds. Proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to shellfish and fish habitats from construction activities.

Although the consumption of fish and shellfish caught in the New Bedford Inner Harbor is regulated by the Massachusetts Department of Public Health (MDPH), consultation with the National Oceanographic Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) should be undertaken during future phases of this project to determine the presence of Essential Fish Habitats (EFH) within New Bedford-Fairhaven Harbor.

Priority Habitats

Alternative 1 is not anticipated to impact priority plant or animal habitats. However, additional field verification and/or consultation with the U.S. Fish and Wildlife Service (USFWS) and MassDEP may be required in future phases of the project to verify the presence of state and federally listed plant and animal species and habitats.

IMPACTS TO AIR QUALITY AND GREENHOUSE GASES FROM IDLING VEHICLES

None of the long-term alternatives, including the No Build Alternative, would increase traffic volumes on the corridor as compared to the 2035 No Build Condition described in Chapter 2. The number of bridge openings would remain the same. Consequently, none of the long-term build alternatives has the potential to worsen air quality compared to the 2035 No Build

Condition. In future phases of the project, a formal air quality evaluation (microscale or mesoscale) would be required to determine the proposed project's impacts as compared to the National Ambient Air Quality Standards (NAAQS).

In Alternative 1, the addition of bicycle and pedestrian facilities along the Route 6 Corridor, including along a new movable span, may have the potential for localized air quality benefits. The addition of these facilities has the potential to shift some motorists to non-motorized modes, potentially reducing the number of idling cars at bridge openings.

Potential temporary impacts to air quality would be anticipated from construction activities. BMPs would be implemented during construction to minimize vehicle emissions and manage fugitive dust. Typical air quality mitigation measures implemented during construction could include dust suppression and control methods to minimize fugitive dust on dry and windy days.

IMPACTS FROM NOISE

Since traffic volumes are not anticipated to increase substantially over existing levels, Alternative 1 is not anticipated to result in noise impacts to nearby noise-sensitive receptors. However, a formal noise assessment in compliance with the FHWA would be required in any future phases of this project.

Potential temporary noise impacts would result from construction activities and the operation of construction equipment. BMPs would be implemented during construction to mitigate potential noise impacts (particularly during non-daytime hours).

4.3.5 Land Use and Economic Development

The following section provides analysis regarding the impacts on businesses, including property acquisition to accommodate bridge construction. Additionally, potential economic benefits of Alternative 1, such as shipper cost savings, are evaluated.

NUMBER/VALUE OF BUSINESSES & JOBS PERMANENTLY IMPACTED

The design of the Alternative 1 bridge utilizes primarily the same footprint as the existing swing span and will not require the acquisition of any additional property or ROW. Furthermore, the operation of the new moveable span will not vary dramatically in a way that would functionally affect the operation of area businesses and would not result in the reduction of the number of jobs. With absence of physical ROW changes and business operational impacts, no business or related property impacts or acquisition is anticipated due to physical or functional impacts.

SHIPPER COST SAVINGS

A variety of both landside and maritime benefits were considered to assess the economic benefits of the long-term build alternatives, including Alternative 1. While some may be quantified, others are more difficult to count and therefore the analysis considered both quantitative and qualitative benefits.

As a first step in the assessment, the potential benefits that could be generated by a new bridge were inventoried. In similar projects, automobile and truck benefits are often included, such as reduced travel time, vehicle operating cost savings, and emissions reduction, among others. On the marine side, moveable bridge improvements can affect shipper costs, travel time, and similar factors.

A thorough review of potential benefits indicated few differences between the 2035 No Build Condition and Alternative 1 in terms of quantifiable benefits. This is due to the relatively small variation between the proposed alternatives and the existing condition in most aspects of transportation. The lack of impact to existing and future traffic conditions results in no benefits from reduced travel time, vehicle operating cost savings, and emissions reduction. However, the change in horizontal clearance for vessels between the existing bridge and Alternative 1 is a significant change. The existing bridge provides a maximum horizontal clearance of 95 feet, while the horizontal clearance for Alternative 1 is 270 feet. While there is a limitation on vertical clearance with Alternative 1, this does not pose an issue for any of the vessels that currently call upon the area inside the bridge.

This analysis only considers the benefits directly related to the bridge, an approach consistent with USDOT benefit-cost analysis guidance. While there is potential for additional economic development at the North Terminal and in the North Harbor, the chosen bridge alternative is only one component of that potential growth. As a result, it would be disingenuous to attribute that economic development potential *exclusively* to the new bridge. Additionally, when looking for the true differences between bridge alternatives, it is important to examine only the benefits associated directly with the bridge.

Landside Benefits

Traditional benefits associated with bridge improvements include both landside and maritime components. In the case of the proposed alternatives, no landside impacts were found. Each of the alternatives maintains the same bridge opening duration and creates no difference in general vehicular, bicycle, or pedestrian traffic operations. In other words, an automobile driver who uses the bridge today would discern no improvement in travel time, or achieve any other transportation related benefits, with a new bridge. Similarly, pedestrian and bicycle traffic would observe no change in their travel time.

It is important to note that the duration and methods for construction may cause various delay or diversion impacts during the construction period. However, no impact was quantified as the transportation analysis showed no discernable diversion patterns that could be analyzed. The construction phase impacts will include a limited road closure while the bridge is being installed along with lane closures for the duration of the construction. It is anticipated that during bridge closures, detours and notifications by area ITS systems will be provided to minimize impacts to drivers. While the impacts cannot easily be quantified, it should be noted that the longer closures will have a greater potential for detrimental impacts to local businesses and diversion costs for roadway users.

Since it was determined that the bridge improvement would have minimal or no impact on long-term landside traffic and pedestrian patterns, no landside benefits were quantified or included in the benefits analysis.

Maritime Benefits

A series of interviews were held with maritime users to determine how the current bridge affects their operations and to identify the ways in which a new bridge could positively affect them. As discussed in Chapter 2, wind and its impact on the navigability through the bridge opening is a critical issue facing maritime users. For this analysis, maritime benefits are primarily due to a reduction in shipper costs associated with delays within New Bedford Harbor. Changes in the use of tugs with Alternative 1 were also considered as a potential benefit. Discussions with maritime experts indicated the tugs used are "ship assist" tugs that primarily aid with alignment to the berth. Accordingly, they will still be required for all large cargo vessels that berth in the North Harbor regardless of the selected alternative and no change to tug costs will occur for larger vessels.

The greatest difference between the No Build Alternative, which retains the existing clearance, and the build alternatives is the horizontal navigational clearance. The No Build Alternative maintains the 95 feet of horizontal navigational clearance, which creates issues for the large vessels that enter the North Harbor. When there are high winds, these vessels cannot transit the bridge until the wind speeds are lower, as there is not enough clearance to pass safely through in high wind conditions.

With Alternative 1, the horizontal navigational width would be 270 feet. This width would remove the need for larger vessels to remain moored south of the bridge should high winds prevail. In the past year, three of the 12 vessels were delayed for one day during their trip to New Bedford due to the existing bridge constraint. It is understood that each day of delay costs the shipper $40,000. Under existing conditions, approximately 25 percent of vessels are delayed for a full day, costing shippers a total of $120,000 per year. With Alternative 1, no ships would experience delay, which results in an average savings of $120,000 per year in shipper costs. Assuming that users of the harbor factor into their overall decision-making the potential cost of delay, the widening of the horizontal clearance would reduce the general cost of using the harbor.

Historically, up to 30 vessels have called upon the port in a single year. This is considered a reasonable upper limit, based on interviews conducted with key maritime users. Assuming that the bridge improvement induces vessel calls to meet this historic high, benefits associated with a reduction in delay time would be generated. These new vessels, however, are not currently using the Port of New Bedford. Rather, they are a projection of potential. As a result, and consistent with economic consumer surplus theory, the benefit they receive would be half of the benefit to existing users.

The change from 12 to 30 trips represents a portion of all potential vessels that did not use the Port of New Bedford under the existing conditions, but that would be "attracted" to New Bedford because the risk of delay and associated costs are mitigated with the wider horizontal clearance. The benefits to these additional vessels are estimated using the "rule of one-half," indicating the change in consumer surplus associated with the removal of the risk of delay. In a future year with 30 total vessels, this would result in a benefit of $20,000 per vessel for the 18 additional vessels, or a total of $360,000.

Summary of Benefits

Table 4.11 summarizes the average annual benefits associated with Alternative 1 as compared to the current conditions that would be maintained under the No Build Alternative. As discussed above, no landside benefits were identified or quantified. Additionally, there would be no change in the number of tugs that would be required, so the total costs would remain the same. The benefits generated by any of the new bridge alternatives is estimated to be $480,000 with delay costs representing $120,000 and savings to new cargo vessels $360,000.

Table 4.11. Average Single-Year Benefits of Bridge Replacement Alternatives

Benefit Category	Annual Savings (2015$)
Landside Transportation Savings	$0
Delay Cost Savings	$120,000
Savings to New Cargo Vessels	$360,000
Change in Tug Costs	$0
Total Benefits	$480,000

4.3.6 Community

The impacts to community resources, such as open space, recreational areas, or historic or cultural resources were also evaluated for Alternative 1. Additionally, access to businesses along the corridor and impacts to Environmental Justice (EJ) populations were evaluated. The study team also considered the visual impacts of a new bridge structure.

IMPACT TO PROTECTED AND RECREATIONAL OPEN SPACE

Alternative 1 would not result in any impacts to protected and/or recreational open space. An evaluation of publicly owned parklands, per Section 4(f) of the Department of Transportation Act of 1966, would be required for any future phases of this project.

As the project development phase continues and the designs for the bridge progresses, special consideration should be given to the location of construction staging areas. Marine Park on Pope's Island is owned and operated by the City of New Bedford and occupies the southern half of the island, but should not be used for construction staging.

IMPACT TO CULTURAL/HISTORIC/ARCHEOLOGICAL RESOURCES

Under Alternative 1, the middle bridge's swing span of the National Register-eligible New Bedford-Fairhaven Bridge would be replaced with a new vertical lift bridge. The loss of the swing span would diminish the integrity of this historic property.

In addition to direct effects to the New Bedford-Fairhaven Bridge, there is the potential for indirect visual effects to historic properties that lie within the larger study area. A portion of the through truss of the existing swing span is visible as a component of the urban/industrial landscape from both the Schooner Ernestina, located on the New Bedford waterfront, and buildings that lie along the eastern edge of the New Bedford Historic District (see Figure 2.11). Both the Schooner Ernestina and the New Bedford Historic District are National Historic Landmarks. The towers of the lift bridge would extend 108 feet above the top of the existing truss. As such, they would be visible as prominent features in the distant skyline from both of these historic properties. While the replacement of the swing span with a vertical lift bridge would alter the visual setting of the New Bedford Historic District and the Schooner Ernestina, it is not anticipated that this would adversely affect these resources given both the distance between the properties and the bridge, and the visual complexity of the viewshed.

Regardless of which long-term alternative is selected, FHWA will need to initiate consultation with the MHC in accordance with Section 106 of the National Historic Preservation Act. Consultation should also be undertaken with the New Bedford and Fairhaven Historical Commissions. Through this consultation, additional historic properties that may be eligible for, but are not yet listed in, the National Register of Historic Places will be identified. The potential for effects to archeological resources will also be determined. FHWA, working together with the MHC, will seek ways to avoid, minimize, or mitigate adverse effects beyond the HAER documentation that has already been completed. In addition to consultation under Section 106, the preparation of a programmatic 4(f) evaluation, in compliance with the U.S. Department of Transportation Act of 1966, will be required.

IMPACT TO BUSINESS ACCESS

The parcels surrounding the approaches to the middle bridge include the following businesses:

- Bridge Shoppes shopping center;
- Captain Leroy's marina;
- Maritime Terminals facility;
- AGM Marine Contractors, Inc.; and
- Tucker Roy Marin Towing and Salvage.

The design of Alternative 1 utilizes primarily the same footprint as the existing swing span. The one modification outside the existing bridge footprint will be the grade (slope) along the western approach needed to allow for the greater vertical clearance of the bridge. This will result in approximately 100 feet of the roadway being raised from one to eight feet, which will be designed without changing the horizontal alignment of the road and will not alter the access to either of the abutting properties. This limited impact to the approaches will not result in any physical changes or impacts to business access.

IMPACT TO ENVIRONMENTAL JUSTICE POPULATIONS

The locations of Environmental Justice (EJ) populations were identified in Chapter 2. Some EJ populations reside in neighborhoods that abut or are adjacent to the New Bedford-Fairhaven

Bridge. Residential clusters of EJ populations reside at the western edge of the local study area in New Bedford and EJ populations (low-income) also reside throughout the local study area within Fairhaven. Consequently, an evaluation of the potential for disproportionately high and adverse human health or environmental effects of the project alternatives on minority populations and low-income populations, per *Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, would be required in future phases of the project to comply with NEPA and MEPA.

Bicycle and pedestrian improvements in Alternative 1 have the potential to substantially improve the ability of EJ populations, who may not own or have access to automobiles, to get across the bridge to access employment or other key destinations. The greatest potential for impacts to EJ populations would occur during construction. Under Alternative 1, the construction phase would be approximately three years long. The bridge would be closed to vehicular, bicycle, and pedestrian traffic for two to four weeks. No transit service currently operates across the bridge.

Alternative 1 also has the potential to result in other temporary construction impacts to the EJ populations located in close proximity to the proposed bridge. Potential impacts could include noise, glare, fumes, and dust from construction equipment as well as changes in traffic patterns and access to businesses due to the movement of construction vehicles. Potential construction period impacts would be mitigated with BMPs for construction activities including those used to minimize dust, noise, maintenance, and protection of traffic plans, and limiting the hours of construction. Further analyses under NEPA and MEPA would be required to determine if construction-related impacts would be disproportionately higher on low-income and minority populations.

Alternative 1, along with all of the long-term build alternatives, has the same proportion of impacts to EJ populations compared to non-EJ populations.

VISUAL IMPACTS

The visual impacts from Alternative 1 will be more significant than most of the bridge alternatives. The towers of the vertical lift bridge would be 150 feet above the bridge deck or 170 feet above MHW. When the bridge is in the open (up) position, the span would be raised approximately 100-125 feet above the roadway surface. For comparison, the top of the truss of the existing bridge is 70 feet above MHW.

These towers would be a prominent feature in the skyline of the harbor. However, due to the terrain in the area and the viewshed of the harbor, while the towers would be visible from many locations due to their height, they would only be visible over the tops of other structures. The towers would only appear visibly imposing from the bridge approaches, from vessels in the harbor or at the harbor's edge. Figures 4.2 and Figure 4.3 provides simulated renderings of what the bridge would look like if standing at Captain Leroy's on Pope's Island.

4.3.7 Alternative Feasibility

The identification of the costs, construction phase impacts, and permanent ROW impacts provide a critical way to evaluate the feasibility of an alternative. This section describes the capital costs, operating and maintenance costs, the construction methodology, a description of impacts to marine and vehicular traffic during construction, and permanent impacts to adjoining properties or businesses.

CAPITAL COSTS

The estimated cost for Alternative 1 is between $90 and $120 million. This capital cost would include the bridge design and permitting, removal and demolition of the existing swing span and construction of the new bridge span. Limits of construction would be generally limited to the 289-foot length of the existing swing span with modifications to the approach spans limited to raising the approaches to provide the necessary under bridge clearances. It is estimated that this work would all be done utilizing the existing piers and newly reconstructed pier caps. In addition, some limited work would be required approximately 100 feet west of the moveable span on the New Bedford approach roadway on Fish Island to change the grade of the roadway.

It is assumed that dredging and disturbance of the harbor sediments would be limited to construction of the tower structures and fendering system, and removal of the existing swing span's center pier structure. A more detailed cost estimate would be developed as additional information regarding subsurface conditions, bridge specifications, and design details are developed through the project development process.

OPERATING AND MAINTENANCE COSTS

Upon completion of construction, Alternative 1 would require both routine maintenance and daily operating costs. Table 4.12 provides the estimated annual costs required to operate and maintain the bridge, which are the same as the other double-leaf alternatives that have two mechanical units to operate and maintain.

Table 4.12. Alternative 1 Annual Operating and Maintenance Costs

Operating Costs	Type	Annual Cost (2015$)
Operating Cost	Electricity utility	$ 100,000
Operating Cost	Stand by generator	$ 2,600
Operating Cost	Bridge operators	$300,000
Routine Maintenance	Monthly bridge lubrication	$ 27,600
Routine Maintenance	Replace lamps	$ 1,500
Routine Maintenance	Replace gate arms	$ 18,000
Routine Maintenance	Miscellaneous minor repairs	$ 20,000
Routine Maintenance	Guard rail repairs	$ 20,000
	TOTAL	$ 489,700

In addition to the annual operating and maintenance costs identified above, Alternative 1 will require major repairs to be conducted on a regular basis to maintain the bridge in a state of good repair and ensure its ongoing utility. The schedule of major repairs included in Table 4.13 is an estimate of repairs that is typical for vertical lift bridges in similar environments. Over a 50-year span, it should be anticipated that approximately $15.5 million worth of repairs (in 2015 dollars) will be required.

Table 4.13. Alternative 1 Schedule of Major Repairs

Year	Work Performed	Cost (2015$)
10	Fender repairs	$ 250,000
15	Minor Structural repairs Deck repairs	$ 1,500,000 $ 250,000
25	Electrical control repairs Minor Structural repairs Fender repair Control House repairs	$ 700,000 $ 1,250,000 $ 250,000 $ 100,000
30	Deck repairs	$ 250,000
35	Replace traffic gates Electrical system rehabilitation Structural rehabilitation Substructure repairs	$ 500,000 $ 2,000,000 $ 4,000,000 $1,000,000
40	Fender repairs Machinery rehabilitation	$ 250,000 $3,000,000
45	Deck repairs	$ 250,000
	TOTAL	$15,550,000

CONSTRUCTION PHASE TRANSPORTATION IMPACTS

The construction phase of this project would be approximately three years long, or 33 to 36 months. This alternative would allow for keeping two or three lanes open for most of the time to vehicular traffic. Both of the existing navigational channels would be open for most of the construction duration. The first two years of construction would be focused on construction of the towers and fabrication (off-site) of the bridge span. One navigational closure would be required during a single long weekend, which would occur in month 28 of construction. During this weekend outage, the existing swing span would be removed while the new lift bridge span would be put into place. During this same month, the roadway would need to be closed for two to four weeks.

CONTRUCTION PHASE IMPACTS TO ABUTTING LAND OWNERS/BUSINESSES

The construction phase of each long-term alternative has the potential to impact area businesses due to the change in access during that period. The construction phase of Alternative 1 would be approximately three years long, or 33 to 36 months. While at least two or three vehicular lanes would be open for most of the construction period, Alternative 1 requires a two to four-week long roadway closure and one marine closure over a long weekend that would result in some impacts to area businesses. Due to the longer construction duration, the Alternative 1 impacts would be greater than the No Build Alternative, but would be less than some of the other build alternatives that require lengthy roadway closures.

4.4 ALTERNATIVE 1T: TALL VERTICAL LIFT BRIDGE

This section provides an evaluation of Alternative 1T: Tall Vertical Lift Bridge consistent with the evaluation criteria established at the initiation of the study. The evaluation criteria are specific measures of effectiveness used to assess benefits and impacts of each alternative.

During the review of impacts of the preliminary set of long-term alternatives, the study team developed Alternative 1T to address the potential vertical clearance needs of changing uses in the North Harbor. Compared to Alternative 1 that provides 135 feet of vertical clearance in the open position, Alternative 1T provides 150 feet of vertical clearance. Both Alternative 1 and Alternative 1T provide 270 feet of navigational clearance. Due to the similarity, Figures 4.2 and 4.3 can be used for visual reference of Alternative 1T.

4.4.1 Bridge Operations

MINUTES PER BRIDGE CLOSURE

The opening sequence of the bridge in all of the long-term alternatives, including Alternative 1T, would continue to follow the AASHTO recommendation that requires approximately four minutes to open and an additional four minutes to close. The average time to open and close the bridge will continue to vary based on the marine traffic transit time and the time required to clear pedestrians and vehicles from the movable span before it can open to marine traffic. The minutes per bridge closure in Alternative 1 is the same as the current condition.

For this alternative, it is possible that the moveable section of the bridge may not be lifted to the full height each time the bridge is opened. A policy could be established to allow the bridge operator to have the discretion to open the bridge to only the height needed to allow the vessels queued to go through the opening. Although this has the potential to sAvenue60 to 90 seconds (which represents about five percent on an average bridge opening), it would only occur when the bridge operator is confident that no tall vessels are planning to transit the bridge at that time.

FEET OF VERTICAL CLEARANCE (OPEN & CLOSED)

The Alternative 1T bridge would be designed to have a vertical clearance of 14 feet above MHW in the closed position and 150 feet above MHW in the open position. Alternative IT provides additional vertical clearance above the 110-135 feet provided by Alternative 1. The No Build Alternative and the bascule alternatives provide unlimited air draft for vessels.

FEET OF HORIZONTAL CLEARANCE

The Alternative 1T bridge would include approximately 270 feet of horizontal navigational clearance. The bridge would be aligned so that the new pier towers are approximately in the same location as the east and west abutments of the existing swing span.

NUMBER OF DAILY BRIDGE OPENINGS

As described in the No Build Alternative, the bridge currently operates on a fixed schedule each day. For all of the long-term alternatives, including Alternative 1T, the schedule and number of daily bridge openings are expected to stay the same.

LONG-TERM RELIABILITY RISK

Since each moveable bridge includes a complex interaction of mechanical, electrical and structural components, there is an inherent risk in a moveable bridge that one of these systems will not operate as designed on any particular day and result in the inability for the bridge to open or close. Some moveable bridge types are at greater risk of inoperability than others due to the nature of their design and the conditions and environment that they operate within. As inoperability of a bridge for a period of time results in community and economic impacts, the risk associated with bridge reliability in the long-term was assessed. This included a general assessment of existing bridges of the type and size under consideration in conditions similar to that of New Bedford Harbor and their ability to remain reliable throughout the life span of the bridge. As noted, all moveable bridges are complex and have some long-term reliability risk. The span width and length of a new vertical lift bridge (Alternative 1T) when operating in the marine costal environment of New Bedford Harbor is estimated to have a medium level of risk. It is likely that even with regular maintenance, the bridge would experience some periods of unanticipated inoperability similar to any moveable bridge in the same location.

4.4.2 Transportation Impacts/Mobility Analysis

The evaluation and assessment of mobility along the corridor between County Street in New Bedford and Adams Street in Fairhaven is an important component of this study. Like of the long-term alternatives, Alternative 1T will not change vehicular traffic along the corridor. Unlike the No Build Alternative, Alternative 1T will provide additional pedestrian and bicycle facilities.

CORRIDOR INTERSECTION LOS, V/C RATIO, QUEUE LENGTHS & ROADWAY TRAVEL TIME/DELAY

As noted in the No Build Alternative analysis, none of the long-term alternatives, including Alternative 1T, will change result in changes to vehicular traffic along the corridor as compared to the 2035 No Build Condition described in Chapter 2. Each of the long-term alternatives being considered will result in the same number of bridge openings and the bridge will, on average, be open for the same duration. Therefore, the mobility analysis described previously in Section 4.2.2 related to the No Build Alternative is consistent with the results of intersection LOS, volume to capacity ratio, queue lengths, and travel time and delay analysis for Alternative 1T.

BICYCLE & PEDESTRIAN MOBILITY/CONNECTIVITY

The width of the existing swing span allows for five-foot-wide sidewalks on both the north and south sides and the roadway shoulders less than two feet in width. The rest of the corridor has a slightly wider right-of-way (ROW), but it is still not wide enough to accommodate five-foot-wide bike lanes. Consequently, bicyclists and pedestrians both use the sidewalks along the bridge corridor segment.

Most pedestrian/bicycle use of the bridge occurs on the southern sidewalk since this sidewalk directly connects to the New Bedford downtown and waterfront. A new pedestrian ramp was completed in 2014 as part of a new roadway ramp from northbound Route 18 to eastbound Route 6. Between the New Bedford and Fairhaven shorelines, pedestrian and bicycle connectivity is difficult due to a lack of secure crossings, ramps, and gaps in the sidewalk network.

Because of these access challenges and safety concerns, pedestrian and bicyclist use of the bridge is currently limited. During the peak hour counts conducted for the study, only one pedestrian was observed to walk the entire length of the bridge between New Bedford and Fairhaven. During the warmer months, it is understood that pedestrian and bicycle use is more frequent and increases during non-peak auto hours.

Like all of the build alternatives, Alternative 1T allows for a wider bridge with a 64-foot-wide ROW. This bridge width allows for the construction of four 11-foot-wide vehicular travel lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. However, while Alternative 1T provides improved facilities compared to the No Build Alternative, the delay for bicyclists and pedestrians will not change as it is controlled by the frequency and duration of bridge openings, which will not change from the current condition.

4.4.3 Safety

Improving roadway, pedestrian, bicycle, and marine safety, reducing conflicts between transportation modes, and increasing emergency vehicle access are important considerations for evaluating the long-term alternatives. This section provides an overview of the key safety concerns that will be addressed by Alternative 1T.

CONFORMANCE WITH AASHTO AND MASSDOT STANDARDS

For a bridge and approach roadway to be safe for vehicular traffic, it must be geometrically adequate. This consideration takes into account the number of lanes, lane and shoulder widths, approach roadway widths, horizontal clearances to roadside obstacles, stopping sight distances, vertical clearances and more. The standards for these criteria are identified in the AASHTO *Policy on Geometric Design of Highways and Streets* and the MassDOT *Project Development and Design Guidebook* (2006). Alternative 1T will conform to these standards with no known variance required.

DELAY TO EMERGENCY VEHICLE ACCESS

Both New Bedford and Fairhaven provide fire and emergency services to their respective municipalities. In case of bridge closure, Pope's Island can receive service from Fairhaven via the East Bridge. St. Luke's Hospital in New Bedford is the only facility in the two municipalities that provides emergency services. Bridge closures can affect Emergency Medical Services (EMS) access to the hospital from Fairhaven. Alternative 1T will not affect the level of access or potential for delay of emergency vehicles compared to the No Build Alternative.

IMPACT TO HIGH VOLUME BICYCLE AND PEDESTRIAN LOCATIONS

A sidewalk runs along the entire length of the north and south sides of the Route 6 Corridor between MacArthur Drive in New Bedford and Middle Street in Fairhaven. When the current roadway construction is completed in 2015, the roadway shoulders will be widened by reducing the vehicular travel lane width. In Alternative 1T, the new bridge cross section will include both widened roadway shoulders and sidewalks. However, even though Alternative 1T provides additional pedestrian and bicycle facilities, high pedestrian or bicycle volumes are not seen on the bridge and are not anticipated in the future. Alternative 1T will have no impact to high volume bicycle or pedestrian locations.

IMPACT TO SAFE NAVIGATION

Due to the existing navigational width of the channels at the existing bridge, safe vessel navigation through the bridge is a serious concern and a significant constraint to the North Harbor. Concerns for safe navigation have resulted in vessel limitations, which have resulted in delays and additional costs for commercial vessels.

Navigation through the bridges 94- and 95-foot-wide channels is the primary concern for large commercial vessels. These vessels generally employ harbor tugs for ship assist when maneuvering through the harbor and the bridge. Even with the tugs, limitations are still in place for transiting through the bridge. These include wind speed, visibility, and daylight.

- Wind speed is the primary concern that limits vessels ability to pass through the bridge. In all cases, if the wind exceeds 25 knots, no large vessel will transit the bridge. If the vessel is over 400 feet in length, this may be reduced to as little as 12 knots given the direction and based on the pilot's discretion.
- No vessel will transit through the bridge if the visibility is less than one nautical mile. Although large vessels don't enter the harbor though the hurricane barrier if visibility is limited, changes in visibility can occur rapidly in the harbor due to fog or heavy precipitation.
- Vessels greater than 500 feet in length or over 80 feet in width transit through the bridge and hurricane barrier in daylight only.

When transiting the current bridge, there is limited room for larger vessels to maneuver, especially north of the bridge between Fish Island and Pope's Island. Vessels approach slowly and then increase speed as they enter the bridge opening to ensure that they can exercise better

control of the vessel through the passage. The limited maneuvering space on either side of the bridge is complicated by the fact that typically ships approach the bridge on an angle due to slow approach speeds. This angle further reduces any free space between the vessel and the bridge as the vessel is moving through. The swing span's central pivot point, associated piers, and fendering system are located approximately in the center of the federal deep-water channel. This makes the bridge, in the perspective of the pilots, the most vulnerable navigation safety area in the harbor.

When larger ships head northbound through the bridge, limited space is available for stopping or maneuvering once they pass the bridge. Generally, two tugs are employed; one at the bow and one at the stern, but only one can assist once the vessel is in the bridge opening due to the width of the channel. The forward tug goes through the bridge first and can come back alongside once the bow clears. Proceeding northbound, once the vessel passes through the bridge and enters the basin, it must slow and stop before being maneuvered into a berth.

Generally, vessels do not require tugs on transiting southbound. When departing southbound, the vessel leaves the berth and turns in the basin in a manner that allows it to line up with the west channel that is used most of the time. Once lined up, it transits the opening and maintains its alignment with the federal deep-water channel.

While the No Build Alternative does not provide any change from the existing condition, Alternative 1T will result in significant improvements to safe navigation through the bridge. The 270 feet of horizontal clearance would mitigate many of the safe navigation concerns, most notably the wind restriction, which has a significant impact on vessel delay. The wider clearance would allow for full tug assistance throughout the bridge transit and would also minimize the impact of the limited maneuverable space in the North Harbor, which will not change as a result of the project.

DELAY TO EMERGENCY MARINE ACCESS

Currently, the swing span impedes emergency vessel access in cases where there is an emergency in the North Harbor since the bridge must open to allow municipal police, fire and rescue, harbormaster, or other emergency response vessels to transit the bridge.
The design of Alternative 1T allows for a vertical clearance of 14 feet in the down (closed) position. This is sufficient clearance for all but the largest emergency response vessels to fit under the bridge without the need to wait for a bridge opening. This would eliminate most of the delay to emergency response currently experienced due to the bridge.

4.4.4 Environment

The following section presents the potential for impacts to the natural environment from Alternative 1T. Compared to the No Build Alternative, Alternative 1T has more potential to impact coastal, wetland, and natural resources due to the required in-water construction. The following sections provide a screening-level assessment, therefore additional and more in-depth analyses of resource impacts would be required, per the National Environmental Policy Act

(NEPA) and the Massachusetts Environmental Policy Act (MEPA), as the designs for the bridge progress.

IMPACT TO COASTAL RESOURCES

Coastal Zone Impacts

The New Bedford-Fairhaven Bridge is located within the designated coastal zone of the Commonwealth of Massachusetts; therefore, this project may be subject to a federal consistency review to ensure that the proposed project would be consistent with the enforceable policies of the federally approved coastal management program of the Commonwealth.

The construction required to raise the elevation of the approach on Fish Island under Alternative 1T has the potential to affect Chapter 91 Tidelands located on the eastern side of the island. A Chapter 91 Waterways authorization from the Massachusetts Department of Environmental Protection (MassDEP) may be required for the construction of new bridge structure and retaining walls between the sidewalk and properties on Fish Island.

Within its policy documents, the Massachusetts Office of Coastal Zone Management (CZM) strongly encourages early coordination with the agency to determine the appropriate level of coastal review that would be required for projects. Coordination with CZM should be undertaken during any future NEPA and MEPA phases of the project.

Floodplains

The proposed bridge would be located within the 100-year floodplain. Alternative 1T would require the construction of permanent foundations for the towers to be constructed within the water, potentially affecting the 100-year floodplain and flood levels within this area. As the design for the bridge progresses, there is the opportunity to limit the size of the foundations, thereby minimizing impacts. Flooding and construction within the 100-year floodplain is under the jurisdiction of CZM; therefore, coordination with CZM would be needed in future phases of the project to determine the extent of potential impacts to the 100-year floodplain and the applicability of coastal hazard policies to this project.

Hazardous and Contaminated Materials

New Bedford-Fairhaven Harbor has been designated as a Superfund Site and is currently undergoing an extensive clean-up effort by the EPA. Alternative 1T would require a substantial amount of in-water construction work. As part of the construction, contaminated soil/sediment from New Bedford Harbor would need to be removed so that new foundations for the bridge towers could be constructed. In-water soil/sediment disturbance would also be expected from the removal of the existing swing span center pier structure. Therefore, Alternative 1 has the potential to result in impacts from the existing contaminated harbor sediments.

As any designs for the bridge progress, coordination would be undertaken with the EPA and the MassDEP to determine the amount of disturbance anticipated during construction, options for mitigation and minimization, and for the appropriate disposal of the contaminated sediments.

IMPACT TO WETLAND RESOURCES

A small area of rocky intertidal wetlands is located on the western shore of Pope's Island. Temporary disturbance resulting from the construction of Alternative 1T may potentially affect this wetland type. Additional field verification of this wetland type, as well as consultation with the USACE and MassDEP, would be needed in future phases of this project to determine the extent of this resource.

Potential impacts to water quality may occur from the disturbance and removal of contaminated sediments from New Bedford-Fairhaven Harbor during construction. Coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination.

Proper erosion and sedimentation controls, as well as stormwater pollution prevention best management practices (BMPs), would be implemented during the construction phase to prevent or avoid any potential impacts to the wetlands and aquatic species known to reside within them. Examples of BMPs include silt fencing, biotubes, and regulated construction entrances. Consultation with USACE and MassDEP regarding avoidance and minimization of potential impacts as well as permitting requirements should be undertaken during any future phases of this project.

As project development progresses, special consideration should be given to the location of construction staging areas on Pope's Island. Coastal bank bluff and sea cliff wetlands form the southern shores of Pope's Island and the placement of construction staging areas within or adjacent to these wetlands should be avoided.

IMPACT TO NATURAL RESOURCES

Alternative 1T would not result in any impacts to Areas of Critical Environmental Concern (ACEC), prime farmland soils, or aquifers. Alternative 1T has the potential for temporary impacts to water quality, shellfish and fish habitat, and priority habitats as a result of construction.

Water Quality

Potential temporary impacts may be anticipated to water quality from the construction of Alternative 1T. Potential impacts to water quality may occur from the disturbance and removal of contaminated sediments from New Bedford-Fairhaven Harbor during construction. Coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination. Additionally, proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to water quality from construction activities.

Shellfish and Fish Habitat

Alternative 1T has the potential to result in temporary impacts to shellfish and fish habitats from the construction of the proposed bridge. Since New Bedford Harbor has been designed as a shellfish growing area, coordination may be needed with MassDEP to ensure that construction activities do not disrupt active shellfish spawning grounds. Proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to shellfish and fish habitats from construction activities.

Although the consumption of fish and shellfish caught in the New Bedford Inner Harbor is regulated by the Massachusetts Department of Public Health (MDPH), consultation with the National Oceanographic Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) should be undertaken during future phases of this project to determine the presence of Essential Fish Habitats (EFH) within New Bedford-Fairhaven Harbor.

Priority Habitats

Alternative 1T is not anticipated to impact priority plant or animal habitats. However, additional field verification and/or consultation with the U.S. Fish and Wildlife Service (USFWS) and MassDEP may be required in future phases of the project to verify the presence of state and federally listed plant and animal species and habitats.

IMPACTS TO AIR QUALITY AND GREENHOUSE GASES FROM IDLING VEHICLES

None of the long-term alternatives, including the No Build Alternative, would increase traffic volumes on the corridor as compared to the 2035 No Build Condition described in Chapter 2. The number of bridge openings would remain the same. Consequently, none of the long-build alternatives has the potential to worsen air quality compared to the 2035 No Build Condition. In future phases of the project, a formal air quality evaluation (microscale or mesoscale) would be required to determine the proposed project's impacts as compared to the National Ambient Air Quality Standards (NAAQS).

In Alternative 1T, the addition of bicycle and pedestrian facilities along the Route 6 Corridor, including along a new movable span, may have the potential for localized air quality benefits. The addition of these facilities has the potential to shift some motorists to non-motorized modes, potentially reducing the number of idling cars at bridge openings.

Potential temporary impacts to air quality would be anticipated from construction activities. BMPs would be implemented during construction to minimize vehicle emissions and manage fugitive dust. Typical air quality mitigation measures implemented during construction could include dust suppression and control methods to minimize fugitive dust on dry and windy days.

IMPACTS FROM NOISE

Since traffic volumes are not anticipated to increase substantially over existing levels, Alternative 1T is not anticipated to result in noise impacts to nearby noise-sensitive receptors.

However, a formal noise assessment in compliance with the FHWA would be required in any future phases of this project.

Potential temporary noise impacts would result from construction activities and the operation of construction equipment. BMPs would be implemented during construction to mitigate potential noise impacts (particularly during non-daytime hours).

4.4.5 Land Use and Economic Development

The following section provides analysis regarding the impacts on businesses, including property acquisition to accommodate bridge construction. Additionally, potential economic benefits of Alternative 1T, such as shipper cost savings, are evaluated.

NUMBER/VALUE OF BUSINESSES PERMANENTLY IMPACTED

The design of the Alternative 1T bridge utilizes primarily the same footprint as the existing swing span and will not require the acquisition of any additional property or ROW. Furthermore, the operation of the new moveable span will not vary dramatically in a way that would functionally affect the operation of area businesses and would not result in the reduction of the number of jobs. With absence of physical ROW changes and business operational impacts, no business or related property impacts or acquisition is anticipated due to physical or functional impacts.

SHIPPER COST SAVINGS

A variety of both landside and maritime benefits were considered to assess the economic benefits of the long-term build alternatives, including Alternative 1T. While some may be quantified, others are more difficult to count and therefore the analysis considered both quantitative and qualitative benefits.

As a first step in the assessment, the potential benefits that could be generated by a new bridge were inventoried. In similar projects, automobile and truck benefits are often included, such as reduced travel time, vehicle operating cost savings, and emissions reduction, among others. On the marine side, moveable bridge improvements can affect shipper costs, travel time, and similar factors.

A thorough review of potential benefits indicated few differences between the 2035 No Build Condition and Alternative 1T in terms of quantifiable benefits. This is due to the relatively small variation between the proposed alternatives and the existing condition in most aspects of transportation. The lack of impact to existing and future traffic conditions results in no benefits from reduced travel time, vehicle operating cost savings, and emissions reduction. However, the change in horizontal clearance for vessels between the existing bridge and Alternative 1T is a significant change. The existing bridge provides a maximum horizontal clearance of 95 feet, while the horizontal clearance for Alternative 1T is 270 feet. While there is a limitation on vertical clearance with Alternative 1, this does not pose an issue for any of the vessels that currently call upon the area inside the bridge.

This analysis only considers the benefits directly related to the bridge, an approach consistent with USDOT benefit-cost analysis guidance. While there is potential for additional economic development at the North Terminal and in the North Harbor, the chosen bridge alternative is only one component of that potential growth. As a result, it would be disingenuous to attribute that economic development potential *exclusively* to the new bridge. Additionally, when looking for the true differences between bridge alternatives, it is important to examine only the benefits associated directly with the bridge.

Landside Benefits

Traditional benefits associated with bridge improvements include both landside and maritime components. In the case of the proposed alternatives, no landside impacts were found. Each of the alternatives maintains the same bridge opening duration and creates no difference in general vehicular, bicycle, or pedestrian traffic operations. In other words, an automobile driver who uses the bridge today would discern no improvement in travel time, or achieve any other transportation related benefits, with a new bridge. Similarly, pedestrian and bicycle traffic would observe no change in their travel time.

It is important to note that the duration and methods for construction may cause various delay or diversion impacts during the construction period. However, no impact was quantified as the transportation analysis showed no discernable diversion patterns that could be analyzed. The construction phase impacts will include a limited road closure while the bridge is being installed along with lane closures for the duration of the construction. It is anticipated that during bridge closures, detours and notifications by area ITS systems will be provided to minimize impacts to drivers. While the impacts cannot easily be quantified, it should be noted that the longer closures will have a greater potential for detrimental impacts to local businesses and diversion costs for roadway users.

Since it was determined that the bridge improvement would have minimal or no impact on long-term landside traffic and pedestrian patterns, no landside benefits were quantified or included in the benefits analysis.

Maritime Benefits

A series of interviews were held with maritime users to determine how the current bridge affects their operations and to identify the ways in which a new bridge could positively affect them. As discussed in Chapter 2, wind and its impact on the navigability through the bridge opening is a critical issue facing maritime users. For this analysis, maritime benefits are primarily due to a reduction in shipper costs associated with delays within New Bedford Harbor. Changes in the use of tugs with Alternative 1T were also considered as a potential benefit. Discussions with maritime experts indicated the tugs used are “ship assist” tugs that primarily aid with alignment to the berth. Accordingly, they will still be required for all large cargo vessels that berth in the North Harbor regardless of the selected alternative and no change to tug costs will occur for larger vessels.

The greatest difference between the No Build Alternative, which retains the existing clearance, and the build alternatives is the horizontal navigational clearance. The No Build Alternative maintains the 95 feet of horizontal navigational clearance, which creates issues for the large vessels that enter the North Harbor. When there are high winds, these vessels cannot transit the bridge until the wind speeds are lower, as there is not enough clearance to pass safely through in high wind conditions.

With Alternative 1T, the horizontal navigational width would be 270 feet. This width would remove the need for larger vessels to remain moored south of the bridge should high winds prevail. In the past year, three of the 12 vessels were delayed for one day during their trip to New Bedford due to the existing bridge constraint. It is understood that each day of delay costs the shipper $40,000. Under existing conditions, approximately 25 percent of vessels are delayed for a full day, costing shippers a total of $120,000 per year. With Alternative 1, no ships would experience delay, which results in an average savings of $120,000 per year in shipper costs. Assuming that users of the harbor factor into their overall decision-making the potential cost of delay, the widening of the horizontal clearance would reduce the general cost of using the harbor.

Historically, up to 30 vessels have called upon the port in a single year. This is considered a reasonable upper limit, based on interviews conducted with key maritime users. Assuming that the bridge improvement induces vessel calls to meet this historic high, benefits associated with a reduction in delay time would be generated. These new vessels, however, are not currently using the Port of New Bedford. Rather, they are a projection of potential. As a result, and consistent with economic consumer surplus theory, the benefit they receive would be half of the benefit to existing users.

The change from 12 to 30 trips represents a portion of all potential vessels that did not use the Port of New Bedford under the existing conditions, but that would be "attracted" to New Bedford because the risk of delay and associated costs are mitigated with the wider horizontal clearance. The benefits to these additional vessels are estimated using the "rule of one-half," indicating the change in consumer surplus associated with the removal of the risk of delay. In a future year with 30 total vessels, this would result in a benefit of $20,000 per vessel for the 18 additional vessels, or a total of $360,000.

Summary of Benefits

Table 4.14 summarizes the average annual benefits associated with Alternative 1T as compared to the current conditions that would be maintained under the No Build Alternative. As discussed above, no landside benefits were identified or quantified. Additionally, there would be no change in the number of tugs that would be required, so the total costs would remain the same. The benefits generated by any of the new bridge alternatives is estimated to be $480,000 with delay costs representing $120,000 and savings to new cargo vessels $360,000.

Table 4.14. Average Single-Year Benefits of Bridge Replacement Alternatives

Benefit Category	Annual Savings (2015$)
Landside Transportation Savings	$0
Delay Cost Savings	$120,000
Savings to New Cargo Vessels	$360,000
Change in Tug Costs	$0
Total Benefits	$480,000

4.4.6 Community

The impacts to community resources, such as open space, recreational areas, or historic or cultural resources were also evaluated for Alternative 1T. Additionally, access to businesses along the corridor and impacts to Environmental Justice (EJ) populations were evaluated. The study team also considered the visual impacts of a new bridge structure.

IMPACT TO PROTECTED AND RECREATIONAL OPEN SPACE

Alternative 1T would not result in any impacts to protected and/or recreational open space. An evaluation of publicly owned parklands, per Section 4(f) of the Department of Transportation Act of 1966, would be required for any future phases of this project.

As the project development phase continues and the designs for the bridge progresses, special consideration should be given to the location of construction staging areas. Marine Park on Pope's Island is owned and operated by the City of New Bedford and occupies the southern half of the island, but should not be used for construction staging.

IMPACT TO CULTURAL/HISTORIC/ARCHEOLOGICAL RESOURCES

Under Alternative 1T, the middle bridge's swing span of the National Register-eligible New Bedford-Fairhaven Bridge would be replaced with a new vertical lift bridge. The loss of the swing span would diminish the integrity of this historic property.

In addition to direct effects to the New Bedford-Fairhaven Bridge, there is the potential for indirect visual effects to historic properties that lie within the larger study area. A portion of the through truss of the existing swing span is visible as a component of the urban/industrial landscape from both the Schooner Ernestina, located on the New Bedford waterfront, and buildings that lie along the eastern edge of the New Bedford Historic District (see Figure 2.11). Both the Schooner Ernestina and the New Bedford Historic District are National Historic Landmarks. The towers of the lift bridge would extend 108 feet above the top of the existing truss. As such, they would be visible as prominent features in the distant skyline from both of these historic properties. While the replacement of the swing span with a vertical lift bridge would alter the visual setting of the New Bedford Historic District and the Schooner Ernestina, it is not anticipated that this would adversely affect these resources given both the distance between the properties and the bridge, and the visual complexity of the viewshed.

Once the preferred long-term alternative has been selected, FHWA will need to initiate consultation with the MHC in accordance with Section 106 of the National Historic Preservation Act. Consultation should also be undertaken with the New Bedford and Fairhaven Historical Commissions. Through this consultation, additional historic properties that may be eligible for, but are not yet listed in, the National Register of Historic Places will be identified. The potential for effects to archeological resources will also be determined. FHWA, working together with the MHC, will seek ways to avoid, minimize, or mitigate adverse effects beyond the HAER documentation that has already been completed. In addition to consultation under Section 106, the preparation of a programmatic 4(f) evaluation, in compliance with the U.S. Department of Transportation Act of 1966, will be required.

IMPACT TO BUSINESS ACCESS

The parcels surrounding the approaches to the middle bridge include the following businesses:

- Bridge Shoppes shopping center;
- Captain Leroy's marina;
- Maritime Terminals facility;
- AGM Marine Contractors, Inc.; and
- Tucker Roy Marin Towing and Salvage.

The design of Alternative 1T utilizes primarily the same footprint as the existing swing span. The one modification outside the existing bridge footprint will be the grade (slope) along the western approach needed to allow for the greater vertical clearance of the bridge. This will result in approximately 100 feet of the roadway being raised from one to eight feet, which will be designed without changing the horizontal alignment of the road and will not alter the access to either of the abutting properties. This limited impact to the approaches will not result in any physical changes or impacts to business access.

IMPACT TO ENVIRONMENTAL JUSTICE POPULATIONS

The locations of Environmental Justice (EJ) populations were identified in Chapter 2. Some EJ populations reside in neighborhoods that abut or are adjacent to the New Bedford-Fairhaven Bridge. Residential clusters of EJ populations reside at the western edge of the local study area in New Bedford and EJ populations (low-income) also reside throughout the local study area within Fairhaven. Consequently, an evaluation of the potential for disproportionately high and adverse human health or environmental effects of the project alternatives on minority populations and low-income populations, per *Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, would be required in future phases of the project to comply with NEPA and MEPA.

Bicycle and pedestrian improvements in Alternative 1T have the potential to substantially improve the ability of EJ populations, who may not own or have access to automobiles, to get across the bridge to access employment or other key destinations. The greatest potential for impacts to EJ populations would occur during construction. Under Alternative 1T, the construction phase would be approximately three years long. The bridge would be closed to vehicular, bicycle, and pedestrian traffic for two to four weeks. No transit service currently operates across the bridge.

Alternative 1T also has the potential to result in other temporary construction impacts to the EJ populations located in close proximity to the proposed bridge. Potential impacts could include noise, glare, fumes, and dust from construction equipment as well as changes in traffic patterns and access to businesses due to the movement of construction vehicles. Potential construction period impacts would be mitigated with BMPs for construction activities including those used to minimize dust, noise, maintenance, and protection of traffic plans, and limiting the hours of construction. Further analyses under NEPA and MEPA would be required to determine if construction-related impacts would be disproportionately higher on low-income and minority populations.

Alternative 1T, along with all of the long-term build alternatives, has the same proportion of impacts to EJ populations compared to non-EJ populations.

VISUAL IMPACTS

The visual impacts from Alternative 1T would be the most significant of all the build alternatives. The towers of the vertical lift bridge would be 200 feet above the bridge deck, or 180 feet above MHW. When the bridge is in the open (up) position, the span would be lifted approximately 140 feet above the level of the approach spans. For comparison, the top of the truss of the existing bridge is 70 feet above MHW.

These towers would be a prominent feature in the skyline of the harbor. However, due to the terrain in the area and the viewshed of the harbor, while the towers would be visible from many locations due to their height, they would only be visible over the tops of other structures. The towers would only appear visibly imposing from the bridge approaches, from vessels in the harbor or at the harbor's edge. Figure 4.1 and Figure 4.2 provides simulated renderings of what the bridge would look like if standing at Captain Leroy's on Pope's Island.

4.4.7 Alternative Feasibility

The identification of the costs, construction phase impacts, and permanent ROW impacts provide a critical way to evaluate the feasibility of an alternative. This section describes the capital costs, operating and maintenance costs, the construction methodology, a description of impacts to marine and vehicular traffic during construction, and permanent impacts to adjoining properties or businesses.

CAPITAL COST

The estimated cost for Alternative 1T is between $100 and $130 million. This capital cost would include the bridge design and permitting, removal and demolition of the existing swing span and construction of the new bridge. Limits of construction would be generally limited to the 289-foot length of the existing swing span with modifications to the approach spans limited to raising the approaches to provide the necessary under bridge clearances. It is estimated that this work would all be done utilizing the existing piers and newly reconstructed pier caps. It is assumed that dredging and disturbance of the harbor sediments would be limited to construction of the tower structures and fendering system and removal of the existing swing span center pier structure. A more detailed cost estimate would be developed as additional information regarding subsurface conditions, bridge specifications, and design details are developed through the project development process.

OPERATING AND MAINTENANCE COSTS

Upon completion of construction, Alternative 1T will require both routine maintenance and daily operating costs. Table 4.15 provides the estimated annual costs required to operate and maintain the bridge, which are the same as the other double-leaf alternatives that have two mechanical units to operate and maintain.

Table 4.15. Alternative 1T Annual Operating and Maintenance Costs

Operating Costs	Type	Annual Cost (2015 $)
Operating Cost	Electricity utility	$ 100,000
Operating Cost	Stand by generator	$ 2,600
Operating Cost	Bridge operators	$300,000
Routine Maintenance	Monthly bridge lubrication	$ 27,600
Routine Maintenance	Replace lamps	$ 1,500
Routine Maintenance	Replace gate arms	$ 18,000
Routine Maintenance	Miscellaneous minor repairs	$ 20,000
Routine Maintenance	Guard rail repairs	$ 20,000
	TOTAL	$ 489,700

In addition to the annual operating and maintenance costs identified above, Alternative 1T will require major repairs to be conducted on a regular basis to maintain the bridge in a state of good repair and ensure its ongoing utility. The schedule of major repairs included in Table 4.16 is an estimate of repairs that is typical for vertical lift bridges in similar environments. Over a 50-year span, it should be anticipated that approximately $15.5 million worth of repairs (in 2015 dollars) will be required.

Table 4.16. Alternative IT Schedule of Major Repairs

Year	Work Performed	Cost (2015$)
10	Fender repairs	$ 250,000
15	Minor Structural repairs Deck repairs	$ 1,500,000 $ 250,000
25	Electrical control repairs Minor Structural repairs Fender repair Control House repairs	$ 700,000 $ 1,250,000 $ 250,000 $ 100,000
30	Deck repairs	$ 250,000
35	Replace traffic gates Electrical system rehabilitation Structural rehabilitation Substructure repairs	$ 500,000 $ 2,000,000 $ 4,000,000 $1,000,000
40	Fender repairs Machinery rehabilitation	$ 250,000 $3,000,000
45	Deck repairs	$ 250,000
	TOTAL	$15,550,000

CONSTRUCTION PHASE TRANSPORTATION IMPACTS

The construction phase of Alternative 1T would be approximately three years long, or 33 to 36 months. This alternative would allow two or three lanes to remain open for most of the time to vehicular traffic. Both of the existing navigational channels would be open for most of the construction duration. The first two years of construction would be focused on construction of the towers and fabrication (off-site) of the bridge span. One navigational closure would be required during a single long weekend, which would occur in month 28 of construction. During this weekend outage, the existing swing span would be removed while the new lift bridge span would be put into place. During this same month, the roadway would need to be closed for two to four weeks.

CONTRUCTION PHASE IMPACTS TO ABUTTING LAND OWNERS/BUSINESSES

The construction phase of each long-term alternative has the potential to impact area businesses due to the change in access during that period. During the three-year-long construction phase of Alternative 1T, at least two or three vehicular lanes would remain open. Alternative 1T requires a two to four-week long roadway closure and one marine closure over a long weekend that would result in some impacts to area businesses. Due to the longer construction duration, the Alternative 1T impacts would be greater than the No Build Alternative, but would be less than some of the other build alternatives that require lengthy roadway closures.

4.5 ALTERNATIVE 2: DOUBLE-LEAF BASCULE BRIDGE

This section provides an evaluation of Alternative 2: Double-leaf Bascule Bridge consistent with the evaluation criteria established at the initiation of the study. The evaluation criteria are specific measures of effectiveness used to assess benefits and impacts of each alternative.

Alternative 2 is a double-leaf bascule bridge (standard) that provides 150 feet of navigational clearance and unlimited air draft. The counterweights and mechanical equipment that is necessary to open the bridge are located in the bascule piers below the bridge deck. Figures 4.4 and 4.5 provide simulated renderings for what Alternative 2 would look like if standing at Captain Leroy's marina on Pope's Island. Figure 4.4 shows the bridge in the closed position (open for vehicular traffic). Figure 4.5 shows the bridge in the open position (closed for vehicular traffic).

Figure 4.4. Alternative 2: Double-leaf Bascule Bridge in Closed Position

Figure 4.5. Alternative 2: Double-leaf Bascule Bridge in Open Position

4.5.1 Bridge Operations

MINUTES PER BRIDGE CLOSURE

The opening sequence of the bridge in all of the long-term alternatives, including Alternative 2, would continue to follow the AASHTO recommendation that requires approximately four minutes to open and an additional four minutes to close. The average time to open and close the bridge will continue to vary based on the marine traffic transit time and the time required to clear pedestrians and vehicles from the movable span before it can open to marine traffic. The minutes per bridge closure in Alternative 2 is the same as the current condition.

FEET OF VERTICAL CLEARANCE (OPEN & CLOSED)

The Alternative 2 bridge would be designed to have a vertical clearance of 14 feet above MHW when the bridge is in the closed position. The bridge would create no vertical clearance restrictions when the bridge is open to marine traffic.

FEET OF HORIZONTAL CLEARANCE

The Alternative 2 bridge would include approximately 150 feet of navigational clearance. The bridge would be aligned so that the eastern bridge abutment is in approximately the same location as the existing eastern abutment, with the western abutment about 150 feet to the west, or in the location of the existing west channel.

NUMBER OF DAILY BRIDGE OPENINGS

As described in the No Build Alternative, the bridge currently operates on a fixed schedule each day. For all of the long-term alternatives, including Alternative 2, the schedule and number of daily bridge openings are expected to stay the same.

LONG-TERM RELIABILITY RISK

Since each moveable bridge includes a complex interaction of mechanical, electrical and structural components, there is an inherent risk in a moveable bridge that one of these systems will not operate as designed on any particular day and result in the inability for the bridge to open or close. Some moveable bridge types are at greater risk of inoperability than others due to the nature of their design and the conditions and environment that they operate within. As inoperability of a bridge for a period of time results in community and economic impacts, the risk associated with bridge reliability in the long-term was assessed. This included a general assessment of existing bridges of the type and size under consideration in conditions similar to that of New Bedford Harbor and their ability to remain reliable throughout the life span of the bridge. As noted, all moveable bridges are complex and have some long-term reliability risk. The span width and length of a new bascule bridge (Alternative 2) when operating in the marine costal environment of New Bedford Harbor is estimated to have a medium level of risk. It is likely that even with regular maintenance, the bridge would experience some periods of unanticipated inoperability similar to any moveable bridge in the same location.

4.5.2 Transportation Impacts & Mobility Analysis

The evaluation and assessment of mobility along the corridor between County Street in New Bedford and Adams Street in Fairhaven is an important component of this study. Like of the long-term alternatives, Alternative 2 will not change vehicular traffic along the corridor. Unlike the No Build Alternative, Alternative 2 will provide additional pedestrian and bicycle facilities.

CORRIDOR INTERSECTION LOS, V/C RATIO, QUEUE LENGTHS & ROADWAY TRAVEL TIME/DELAY

As noted in the No Build Alternative analysis, none of the long-term alternatives, including Alternative 2, will result in changes to vehicular traffic along the corridor as compared to the 2035 No Build Condition described in Chapter 2. Each of the long-term alternatives being considered will result in the same number of bridge openings and the bridge will, on average, be open for the same duration. Therefore, the mobility analysis described previously in Section 4.2.2 related to the No Build Alternative is consistent with the results of intersection LOS, volume to capacity ratio, queue lengths, and travel time and delay analysis for Alternative 2.

BICYCLE & PEDESTRIAN MOBILITY/CONNECTIVITY

The width of the existing swing span allows for five-foot-wide sidewalks on both the north and south sides and the roadway shoulders less than two feet in width. The rest of the corridor has a slightly wider right-of-way (ROW), but it is still not wide enough to accommodate five-foot-wide bike lanes. Consequently, bicyclists and pedestrians both use the sidewalks along the bridge corridor segment.

Most pedestrian/bicycle use of the bridge occurs on the southern sidewalk since this sidewalk directly connects to the New Bedford downtown and waterfront. A new pedestrian ramp was completed in 2014 as part of a new roadway ramp from northbound Route 18 to eastbound Route 6. Between the New Bedford and Fairhaven shorelines, pedestrian and bicycle connectivity is difficult due to a lack of secure crossings, ramps, and gaps in the sidewalk network.

Because of these access challenges and safety concerns, pedestrian and bicyclist use of the bridge is currently limited. During the peak hour counts conducted for the study, only one pedestrian was observed to walk the entire length of the bridge between New Bedford and Fairhaven. During the warmer months, it is understood that pedestrian and bicycle use is more frequent and increases during non-peak auto hours.

Like all of the build alternatives, Alternative 2 allows for a wider bridge with a 64-foot-wide ROW. This bridge width allows for the construction of four 11-foot-wide vehicular travel lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. However, while Alternative 2 provides improved facilities compared to the No Build Alternative, the delay for bicyclists and pedestrians will not change as it is controlled by the frequency and duration of bridge openings, which will not change from the current condition.

4.5.3 Safety

Improving roadway, pedestrian, bicycle, and marine safety, reducing conflicts between transportation modes, and increasing emergency vehicle access are important considerations for evaluating the long-term alternatives. This section provides an overview of the key safety concerns that will be addressed by Alternative 2.

CONFORMANCE WITH AASHTO AND MASSDOT STANDARDS

For a bridge and approach roadway to be safe for vehicular traffic, it must be geometrically adequate. This consideration takes into account the number of lanes, lane and shoulder widths, approach roadway widths, horizontal clearances to roadside obstacles, stopping sight distances, vertical clearances and more. The standards for these criteria are identified in the AASHTO *Policy on Geometric Design of Highways and Streets* and the MassDOT *Project Development and Design Guidebook* (2006). Alternative 2 will conform to these standards with no known variance required.

DELAY TO EMERGENCY VEHICLE ACCESS

Both New Bedford and Fairhaven provide fire and emergency services to their respective municipalities. In case of bridge closure, Pope's Island can receive service from Fairhaven via the East Bridge. St. Luke's Hospital in New Bedford is the only facility in the two municipalities that provides emergency services. Bridge closures can affect Emergency Medical Services (EMS) access to the hospital from Fairhaven. Alternative 2 will not affect the level of access or potential for delay of emergency vehicles compared to the No Build Alternative.

IMPACT TO HIGH VOLUME BICYCLE AND PEDESTRIAN LOCATIONS

A sidewalk runs along the entire length of the north and south sides of the Route 6 Corridor between MacArthur Drive in New Bedford and Middle Street in Fairhaven. When the current roadway construction is completed in 2015, the roadway shoulders will be widened by reducing the vehicular travel lane width. In Alternative 2, the new bridge cross section will include both widened roadway shoulders and sidewalks. However, even though Alternative 2 provides additional pedestrian and bicycle facilities, high pedestrian or bicycle volumes are not seen on the bridge and are not anticipated in the future. Alternative 2 will have no impact to high volume bicycle or pedestrian locations.

IMPACT TO SAFE NAVIGATION

Due to the existing navigational width of the channels at the existing bridge, safe vessel navigation through the bridge is a serious concern and a significant constraint to the North Harbor. Concerns for safe navigation have resulted in vessel limitations, which have resulted in delays and additional costs for commercial vessels.

Navigation through the bridges 94- and 95-foot-wide channels is the primary concern for large commercial vessels. These vessels generally employ harbor tugs for ship assist when maneuvering through the harbor and the bridge. Even with the tugs, limitations are still in place for transiting through the bridge. These include wind speed, visibility, and daylight.

- Wind speed is the primary concern that limits vessels ability to pass through the bridge. In all cases, if the wind exceeds 25 knots, no large vessel will transit the bridge. If the vessel is over 400 feet in length, this may be reduced to as little as 12 knots given the direction and based on the pilot's discretion.
- No vessel will transit through the bridge if the visibility is less than one nautical mile. Although large vessels don't enter the harbor though the hurricane barrier if visibility is limited, changes in visibility can occur rapidly in the harbor due to fog or heavy precipitation.
- Vessels greater than 500 feet in length or over 80 feet in width transit through the bridge and hurricane barrier in daylight only.

When transiting the current bridge, there is limited room for larger vessels to maneuver, especially north of the bridge between Fish Island and Pope's Island. Vessels approach slowly and then increase speed as they enter the bridge opening to ensure that they can exercise better

control of the vessel through the passage. The limited maneuvering space on either side of the bridge is complicated by the fact that typically ships approach the bridge on an angle due to slow approach speeds. This angle further reduces any free space between the vessel and the bridge as the vessel is moving through. The swing span's central pivot point, associated piers, and fendering system are located approximately in the center of the federal deep-water channel. This makes the bridge, in the perspective of the pilots, the most vulnerable navigation safety area in the harbor.

When larger ships head northbound through the bridge, limited space is available for stopping or maneuvering once they pass the bridge. Generally, two tugs are employed; one at the bow and one at the stern, but only one can assist once the vessel is in the bridge opening due to the width of the channel. The forward tug goes through the bridge first and can come back alongside once the bow clears. Proceeding northbound, once the vessel passes through the bridge and enters the basin, it must slow and stop before being maneuvered into a berth.

Generally, vessels do not require tugs on transiting southbound. When departing southbound, the vessel leaves the berth and turns in the basin in a manner that allows it to line up with the west channel that is used most of the time. Once lined up, it transits the opening and maintains its alignment with the federal deep-water channel.

While the No Build Alternative does not provide any change from the existing condition, Alternative 2 will result in improvements to safe navigation through the bridge. Operations of the large vessels transiting though the Alternative 2 bridge would not change dramatically from the No Build Condition due to limitations caused by visibility and daylight.

The 150-foot-wide clearance is considered the minimum acceptable width for safe navigation into the North Harbor. As noted two tugs are typically employed for large vessels; one at the bow and one at the stern, with only one able to assist once the vessel is in the bridge opening. This will remain the same for the Alternative 2 bridge. Additionally, the limited maneuvering space on either side of the bridge is complicated by the fact that typically ships approach the bridge on an angle due to slow approach speeds. This angle further reduces any free space between the vessel and the bridge as the vessel is moving through. With a 150-foot-wide navigational clearance the width would still be anticipated to be a concern for the larger ships.

To mitigate this concern, an enhanced fendering system is suggested for construction as part of the bridge. This would include "transit fenders where part of the maneuver involves laying the vessel alongside the fenders and moving forward along the fendering structure as you approach and pass through the bridge opening. This is similar to the system in the Panama Canal and is used effectively to assist in navigation.

DELAY TO EMERGENCY MARINE ACCESS

Currently, the swing span impedes emergency vessel access in cases where there is an emergency in the North Harbor since the bridge must open to allow municipal police, fire and rescue, harbormaster, or other emergency response vessels to transit the bridge.

The design of Alternative 2 allows for a vertical clearance of 14 feet in the down (closed) position. This is sufficient clearance for all but the largest emergency response vessels to fit under the bridge without the need to wait for a bridge opening. This would eliminate most of the delay to emergency response currently experienced due to the bridge.

4.5.4 Environment

The following section presents the potential for impacts to the natural environment from Alternative 2. Compared to the No Build Alternative, Alternative 2 has more potential to impact coastal, wetland, and natural resources due to the required in-water construction. The following sections provide a screening-level assessment, therefore additional and more in-depth analyses of resource impacts would be required, per the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA), as the designs for the bridge progress.

IMPACT TO COASTAL RESOURCES

Coastal Zone Impacts

The New Bedford-Fairhaven Bridge is located within the designated coastal zone of the Commonwealth of Massachusetts; therefore, this project may be subject to a federal consistency review to ensure that the proposed project would be consistent with the enforceable policies of the federally approved coastal management program of the Commonwealth.

The construction required to raise the elevation of the approach on Fish Island under Alternative 2 has the potential to affect Chapter 91 Tidelands located on the eastern side of the island. A Chapter 91 Waterways authorization from the Massachusetts Department of Environmental Protection (MassDEP) may be required for the construction of new bridge structure.

Within its policy documents, the Massachusetts Office of Coastal Zone Management (CZM) strongly encourages early coordination with the agency to determine the appropriate level of coastal review that would be required for projects. Coordination with CZM should be undertaken during any future NEPA and MEPA phases of the project.

Floodplains

The proposed bridge would be located within the 100-year floodplain. Alternative 2 would require the construction of permanent foundations for the bascule piers to be constructed within the water, potentially affecting the 100-year floodplain and flood levels within this area. As the design for the bridge progresses, there is the opportunity to limit the size of the foundations, thereby minimizing impacts. Flooding and construction within the 100-year floodplain is under the jurisdiction of CZM. Therefore, coordination with CZM would be needed in future phases of the project to determine the extent of potential impacts to the 100-year floodplain and the applicability of coastal hazard policies to this project.

Hazardous and Contaminated Materials

New Bedford Harbor has been designated as a Superfund Site and is currently undergoing an extensive clean-up effort by the EPA. Alternative 2 would require a substantial amount of in-water construction work. As part of the construction, contaminated soil/sediment from New Bedford Harbor would need to be removed so that new bascule piers could be constructed. These structures would be at least 24 feet by 64 feet and would require a significant amount of soil disturbance below the water line. In-water soil/sediment disturbance would also be expected from the removal of the existing swing span center pier structure. Therefore, Alternative 2 has the potential to result in impacts from the existing contaminated harbor sediments, greater than those potential impacts anticipated for most of the other long-term alternatives.

As any designs for the bridge progress, coordination would be undertaken with the EPA and the MassDEP to determine the amount of disturbance anticipated during construction, options for mitigation and minimization, and for the appropriate disposal of the contaminated sediments.

IMPACT TO WETLAND RESOURCES

A small area of rocky intertidal wetlands is located on the western shore of Pope's Island. Temporary disturbance resulting from the construction of Alternative 2 may potentially affect this wetland type. Additional field verification of this wetland type, as well as consultation with the USACE and MassDEP, would be needed in future phases of this project to determine the extent of this resource.

Potential impacts to water quality may occur from the disturbance and removal of contaminated sediments from New Bedford-Fairhaven Harbor during construction. Coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination.

Proper erosion and sedimentation controls, as well as stormwater pollution prevention best management practices (BMPs), would be implemented during the construction phase to prevent or avoid any potential impacts to the wetlands and aquatic species known to reside within them. Examples of BMPs include silt fencing, biotubes, and regulated construction entrances. Consultation with USACE and MassDEP regarding avoidance and minimization of potential impacts as well as permitting requirements should be undertaken during any future phases of this project.

As project development progresses, special consideration should be given to the location of construction staging areas on Pope's Island. Coastal bank bluff and sea cliff wetlands form the southern shores of Pope's Island and the placement of construction staging areas within or adjacent to these wetlands should be avoided.

IMPACT TO NATURAL RESOURCES

Alternative 2 would not result in any impacts to Areas of Critical Environmental Concern (ACEC), prime farmland soils, or aquifers. Alternative 2 has the potential for greater impacts to water quality, shellfish and fish habitat, and priority habitats than the No Build Alternative.

Water Quality

Alternative 2 would require a substantial amount of in-water construction work. As part of the construction, contaminated soil/sediment from New Bedford Harbor would need to be removed so that new bascule piers could be constructed. These structures would be at least 24 feet by 64 feet and would require a significant amount of soil disturbance below the water line. Therefore, the potential for impacts to water quality from Alternative 2 would be greater than the No Build Alternative and most of the build alternatives. Additionally, potential impacts from the in-water soil/sediment disturbance from the removal of the existing swing span center pier structure would be the same as the other build alternatives, but greater than the No Build Alternative. Similar to the other long-term alternatives, coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination. Additionally, proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to water quality from construction activities.

Shellfish and Fish Habitat

Due to the substantial in-water construction that would be required, the construction of Alternative 2 would have the potential to result in greater temporary impacts to shellfish and fish habitats than the No Build Alternative. Similar to the other long-term alternatives, coordination may be needed with MassDEP to ensure that construction activities do not disrupt active shellfish spawning grounds. Proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to shellfish and fish habitats from construction activities.

Although the consumption of fish and shellfish caught in the New Bedford Inner Harbor is regulated by the Massachusetts Department of Public Health (MDPH), consultation with the National Oceanographic Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) should be undertaken during future phases of this project to determine the presence of Essential Fish Habitats (EFH) within New Bedford-Fairhaven Harbor.

Priority Habitats

Alternative 2 is not anticipated to impact priority plant or animal habitats. However, additional field verification and/or consultation with the U.S. Fish and Wildlife Service (USFWS) and MassDEP may be required in future phases of the project to verify the presence of state and federally listed plant and animal species and habitats.

IMPACTS TO AIR QUALITY AND GREENHOUSE GASES FROM IDLING VEHICLES

None of the long-term alternatives, including the No Build Alternative, would increase traffic volumes on the corridor as compared to the 2035 No Build Condition described in Chapter 2. The number of bridge openings would remain the same. Consequently, none of the long-build alternatives has the potential to worsen air quality compared to the 2035 No Build Condition. In future phases of the project, a formal air quality evaluation (microscale or mesoscale) would be required to determine the proposed project's impacts as compared to the National Ambient Air Quality Standards (NAAQS).

In Alternative 2, the addition of bicycle and pedestrian facilities along the Route 6 Corridor, including along a new movable span, may have the potential for localized air quality benefits. The addition of these facilities has the potential to shift some motorists to non-motorized modes, potentially reducing the number of idling cars at bridge openings.

Potential temporary impacts to air quality would be anticipated from construction activities. BMPs would be implemented during construction to minimize vehicle emissions and manage fugitive dust. Typical air quality mitigation measures implemented during construction could include dust suppression and control methods to minimize fugitive dust on dry and windy days.

IMPACTS FROM NOISE

Since traffic volumes are not anticipated to increase substantially over existing levels, Alternative 2 is not anticipated to result in noise impacts to nearby noise-sensitive receptors. However, a formal noise assessment in compliance with the FHWA would be required in any future phases of this project.

Potential temporary noise impacts would result from construction activities and the operation of construction equipment. BMPs would be implemented during construction to mitigate potential noise impacts (particularly during non-daytime hours).

4.5.5 Land Use & Economic Development

The following section provides analysis regarding the impacts on businesses, including property acquisition to accommodate bridge construction. Additionally, potential economic benefits of Alternative 2, such as shipper cost savings, are evaluated.

NUMBER/VALUE OF BUSINESSES & JOBS PERMANENTLY IMPACTED

The design of the Alternative 2 bridge utilizes primarily the same footprint as the existing swing span and will not require the acquisition of any additional property or ROW. Furthermore, the operation of the new moveable span will not vary dramatically in a way that would functionally affect the operation of area businesses and would not result in the reduction of the number of jobs. With absence of physical ROW changes and business operational impacts, no business or related property impacts or acquisition is anticipated due to physical or functional impacts.

SHIPPER COST SAVINGS

A variety of both landside and maritime benefits were considered to assess the economic benefits of the long-term build alternatives, including Alternative 2. While some may be quantified, others are more difficult to count and therefore the analysis considered both quantitative and qualitative benefits.

As a first step in the assessment, the potential benefits that could be generated by a new bridge were inventoried. In similar projects, automobile and truck benefits are often included, such as reduced travel time, vehicle operating cost savings, and emissions reduction, among others. On the marine side, moveable bridge improvements can affect shipper costs, travel time, and similar factors.

A thorough review of potential benefits indicated few differences between the 2035 No Build Condition and Alternative 2 in terms of quantifiable benefits. This is due to the relatively small variation between the proposed alternatives and the existing condition in most aspects of transportation. The lack of impact to existing and future traffic conditions results in no benefits from reduced travel time, vehicle operating cost savings, and emissions reduction. However, the change in horizontal clearance for vessels between the existing bridge and Alternative 2 is a significant change. The existing bridge provides a maximum horizontal clearance of 95 feet, while the horizontal clearance for Alternative 2 is 150 feet. Alternative 2 has no limitations on the vertical clearance of vessels.

This analysis only considers the benefits directly related to the bridge, an approach consistent with USDOT benefit-cost analysis guidance. While there is potential for additional economic development at the North Terminal and in the North Harbor, the chosen bridge alternative is only one component of that potential growth. As a result, it would be disingenuous to attribute that economic development potential *exclusively* to the new bridge. Additionally, when looking for the true differences between bridge alternatives, it is important to examine only the benefits associated directly with the bridge.

Landside Benefits

Traditional benefits associated with bridge improvements include both landside and maritime components. In the case of the proposed alternatives, no landside impacts were found. Each of the alternatives maintains the same bridge opening duration and creates no difference in general vehicular, bicycle, or pedestrian traffic operations. In other words, an automobile driver who uses the bridge today would discern no improvement in travel time, or achieve any other transportation related benefits, with a new bridge. Similarly, pedestrian and bicycle traffic would observe no change in their travel time.

It is important to note that the duration and methods for construction may cause various delay or diversion impacts during the construction period. However, no impact was quantified as the transportation analysis showed no discernable diversion patterns that could be analyzed. The construction phase impacts will include a limited road closure while the bridge is being installed along with lane closures for the duration of the construction. It is anticipated that during bridge closures, detours and notifications by area ITS systems will be provided to minimize impacts to drivers. While the impacts cannot easily be quantified, it should be noted that the longer closures will have a greater potential for detrimental impacts to local businesses and diversion costs for roadway users.

Since it was determined that the bridge improvement would have minimal or no impact on long-term landside traffic and pedestrian patterns, no landside benefits were quantified or included in the benefits analysis.

Maritime Benefits

A series of interviews were held with maritime users to determine how the current bridge affects their operations and to identify the ways in which a new bridge could positively affect them. As discussed in Chapter 2, wind and its impact on the navigability through the bridge opening is a critical issue facing maritime users. For this analysis, maritime benefits are primarily due to a reduction in shipper costs associated with delays within New Bedford Harbor. Changes in the use of tugs with Alternative 2 were also considered as a potential benefit. Discussions with maritime experts indicated the tugs used are "ship assist" tugs that primarily aid with alignment to the berth. Accordingly, they will still be required for all large cargo vessels that berth in the North Harbor regardless of the selected alternative and no change to tug costs will occur for larger vessels.

The greatest difference between the No Build Alternative, which retains the existing clearance, and the build alternatives is the horizontal navigational clearance. The No Build Alternative maintains the 95 feet of horizontal navigational clearance, which creates issues for the large vessels that enter the North Harbor. When there are high winds, these vessels cannot transit the bridge until the wind speeds are lower, as there is not enough clearance to pass safely through in high wind conditions.

With Alternative 2, the horizontal navigational width would be 150 feet. This width would remove the need for larger vessels to remain moored south of the bridge should high winds prevail. In the past year, three of the 12 vessels were delayed for one day during their trip to New Bedford due to the existing bridge constraint. It is understood that each day of delay costs the shipper $40,000. Under existing conditions, approximately 25 percent of vessels are delayed for a full day, costing shippers a total of $120,000 per year. With Alternative 2, no ships would experience delay, which results in an average savings of $120,000 per year in shipper costs. Assuming that users of the harbor factor into their overall decision-making the potential cost of delay, the widening of the horizontal clearance would reduce the general cost of using the harbor.

Historically, up to 30 vessels have called upon the port in a single year. This is considered a reasonable upper limit, based on interviews conducted with key maritime users. Assuming that the bridge improvement induces vessel calls to meet this historic high, benefits associated with a reduction in delay time would be generated. These new vessels, however, are not currently using the Port of New Bedford. Rather, they are a projection of potential. As a result, and consistent with economic consumer surplus theory, the benefit they receive would be half of the benefit to existing users.

The change from 12 to 30 trips represents a portion of all potential vessels that did not use the Port of New Bedford under the existing conditions, but that would be "attracted" to New Bedford because the risk of delay and associated costs are mitigated with the wider horizontal clearance. The benefits to these additional vessels are estimated using the "rule of one-half," indicating the change in consumer surplus associated with the removal of the risk of delay. In a future year with 30 total vessels, this would result in a benefit of $20,000 per vessel for the 18 additional vessels, or a total of $360,000.

Summary of Benefits

Table 4.17 summarizes the average annual benefits associated with Alternative 2 as compared to the current conditions that would be maintained under the No Build Alternative. As discussed above, no landside benefits were identified or quantified. Additionally, there would be no change in the number of tugs that would be required, so the total costs would remain the same. The benefits generated by any of the new bridge alternatives is estimated to be $480,000 with delay costs representing $120,000 and savings to new cargo vessels $360,000.

Table 4.17. Average Single-Year Benefits of Bridge Replacement Alternatives

Benefit Category	Annual Savings (2015$)
Landside Transportation Savings	$0
Delay Cost Savings	$120,000
Savings to New Cargo Vessels	$360,000
Change in Tug Costs	$0
Total Benefits	$480,000

4.5.6 Community

The impacts to community resources, such as open space, recreational areas, or historic or cultural resources were also evaluated for Alternative 2. Additionally, access to businesses along the corridor and impacts to Environmental Justice (EJ) populations were evaluated. The study team also considered the visual impacts of a new bridge structure.

IMPACT TO PROTECTED AND RECREATIONAL OPEN SPACE

Alternative 2 would not result in any impacts to protected and/or recreational open space. An evaluation of publicly owned parklands, per Section 4(f) of the Department of Transportation Act of 1966, would be required for any future phases of this project.

As the project development phase continues and the designs for the bridge progresses, special consideration should be given to the location of construction staging areas. Marine Park on Pope's Island is owned and operated by the City of New Bedford and occupies the southern half of the island, but should not be used for construction staging.

IMPACT TO CULTURAL/HISTORIC/ARCHEOLOGICAL RESOURCES

Under Alternative 2, the middle bridge's swing span of the National Register-eligible New Bedford-Fairhaven Bridge would be replaced with a new double-leaf bascule bridge. The loss of the swing span would diminish the integrity of this historic property.

In addition to direct effects to the New Bedford-Fairhaven Bridge, there is the potential for indirect visual effects to historic properties that lie within the larger study area. A portion of the through truss of the existing swing span is visible as a component of the urban/industrial landscape from both the Schooner Ernestina, located on the New Bedford waterfront, and buildings that lie along the eastern edge of the New Bedford Historic District (see Figure 2.11). Both the Schooner Ernestina and the New Bedford Historic District are National Historic Landmarks. Due to the lack of a truss and thus the lower profile of the bridge, it is unlikely that the new bridge would be visible when in the closed position. It would be visible from the New Bedford Historic District and the Schooner Ernestina when in the open (up) position, as the top of the bridge would extend approximately 28 feet higher than the top of the existing truss when measured from the water. While the replacement of the swing span through truss with a double-leaf bascule span would alter the visual setting of these two historic properties, it is not anticipated that this would adversely affect these resources given both the distance between the properties and the bridge, and the visual complexity of the viewshed.

Regardless of which long-term alternative is selected, FHWA will need to initiate consultation with the MHC in accordance with Section 106 of the National Historic Preservation Act. Consultation should also be undertaken with the New Bedford and Fairhaven Historical Commissions. Through this consultation, additional historic properties that may be eligible for, but are not yet listed in, the National Register of Historic Places will be identified. The potential for effects to archeological resources will also be determined. FHWA, working together with the MHC, will seek ways to avoid, minimize, or mitigate adverse effects beyond the HAER documentation that has already been completed. In addition to consultation under Section 106, the preparation of a programmatic 4(f) evaluation, in compliance with the U.S. Department of Transportation Act of 1966, will be required.

IMPACT TO BUSINESS ACCESS

The parcels surrounding the approaches to the middle bridge include the following businesses:

- Bridge Shoppes shopping center;
- Captain Leroy's marina;
- Maritime Terminals facility;
- AGM Marine Contractors, Inc.; and
- Tucker Roy Marin Towing and Salvage.

Alternative 2 does not include any modifications to the bridge approaches and utilizes the existing footprint. The horizontal alignment of the road and access to abutting properties will remain the same.

IMPACT TO ENVIRONMENTAL JUSTICE POPULATIONS

The locations of Environmental Justice (EJ) populations were identified in Chapter 2. Some EJ populations reside in neighborhoods that abut or are adjacent to the New Bedford-Fairhaven Bridge. Residential clusters of EJ populations reside at the western edge of the local study area in New Bedford and EJ populations (low-income) also reside throughout the local study area within Fairhaven. Consequently, an evaluation of the potential for disproportionately high and adverse human health or environmental effects of the project alternatives on minority populations and low-income populations, per *Executive Order 12898, Federal Actions to Address*

Environmental Justice in Minority Populations and Low-Income Populations, would be required in future phases of the project to comply with NEPA and MEPA.
Bicycle and pedestrian improvements in Alternative 2 have the potential to substantially improve the ability of EJ populations, who may not own or have access to automobiles, to get across the bridge to access employment or other key destinations. The greatest potential for impacts to EJ populations would occur during construction. Under Alternative 2, the construction phase would be approximately three years long. The bridge would be closed to vehicular, bicycle, and pedestrian traffic for two years. No transit service currently operates across the bridge.

Alternative 2 also has the potential to result in other temporary construction impacts to the EJ populations located in close proximity to the proposed bridge. Potential impacts could include noise, glare, fumes, and dust from construction equipment as well as changes in traffic patterns and access to businesses due to the movement of construction vehicles. Potential construction period impacts would be mitigated with BMPs for construction activities including those used to minimize dust, noise, maintenance, and protection of traffic plans, and limiting the hours of construction. Further analyses under NEPA and MEPA would be required to determine if construction-related impacts would be disproportionately higher on low-income and minority populations.

Alternative 2, along with all of the long-term build alternatives, has the same proportion of impacts to EJ populations compared to non-EJ populations.

VISUAL IMPACTS

The visual impacts from Alternative 2 would be limited. When the bridge is in the down position, it would look similar to the fixed spans of the east and west bridges. However, when the bridge is in the up (or open) position the bridge leafs would extend approximately 75 feet above the roadway surface, or 95 feet above MHW. This is approximately 25 feet higher than the top of the existing truss. Although the bridge would be visible from a greater distance while in the up position, the topography and the significant development that surrounds the harbor would shield the view of the bridge from most locations. Figures 4.4 and 4.5 provide simulated renderings of what the bridge would look like if standing at Captain Leroy's on Pope's Island.

4.5.7 Alternative Feasibility

The identification of the costs, construction phase impacts, and permanent ROW impacts provide a critical way to evaluate the feasibility of an alternative. This section describes the capital costs, operating and maintenance costs, the construction methodology, a description of impacts to marine and vehicular traffic during construction, and permanent impacts to adjoining properties or businesses.

CAPITAL COST

The estimated cost for Alternative 2 is between $85 and $100 million. This capital cost would include the bridge design and permitting, removal and demolition of the existing swing span and construction of the new bridge. The limits of construction would be generally limited to the 289-foot length of the existing swing span with modifications to the approach spans limited to raising the approaches to provide the necessary under bridge clearances. It is estimated that this work would all be done utilizing the existing piers and newly reconstructed pier caps. It is assumed that dredging and disturbance of the harbor sediments would be limited to construction of the tower structures and fendering system and removal of the existing swing bridge center pier structure. A more detailed cost estimate would be developed as additional information regarding subsurface conditions, bridge specifications, and design details are developed through the project development process.

OPERATING AND MAINTENANCE COSTS

Upon completion of construction, Alternative 2 will require both routine maintenance and daily operating costs. Table 4.18 provides the estimated annual costs required to operate and maintain the bridge, which are the same as the other double-leaf alternatives that have two mechanical units to operate and maintain.

Table 4.18. Alternative 2 Annual Operating and Maintenance Costs

Operating Costs	Type	Annual Cost (2015 $)
Operating Cost	Electricity utility	$ 100,000
Operating Cost	Stand by generator	$ 2,600
Operating Cost	Bridge operators	$300,000
Routine Maintenance	Monthly bridge lubrication	$ 27,600
Routine Maintenance	Replace lamps	$ 1,500
Routine Maintenance	Replace gate arms	$ 18,000
Routine Maintenance	Miscellaneous minor repairs	$ 20,000
Routine Maintenance	Guard rail repairs	$ 20,000
	TOTAL	$ 489,700

In addition to the annual operating and maintenance costs identified above, Alternative 2 will require major repairs to be conducted on a regular basis to maintain the bridge in a state of good repair and ensure its on-going utility. The schedule of major repairs included in Table 4.19 is an estimate of repairs that is typical for bascule bridges in similar environments. Over a 50-year span, it should be anticipated that approximately $14.6 million worth of repairs (in 2015 dollars) will be required.

Table 4.19. Alternative 2 Schedule of Major Repairs

Year	Work Performed	Cost (2015$)
10	Fender repairs	$250,000
15	Minor structural repairs	$1,250,000
20	Deck repairs	$250,000
25	Electrical control repairs Minor structural repairs Fender repair Control house repairs	$700,000 1,250,000 $250,000 $100,000
30	Deck repairs	$250,000
35	Replace traffic gates Electrical system rehabilitation Structrural rehabilitation Substructure repairs	$300,000 $2,000,000 $3,500,000 $1,000,000
40	Fender repairs Machinery rehabilitation	$250,000 $3,000,000
45	Deck repairs	$250,000
	TOTAL	$14,600,000

CONSTRUCTION PHASE TRANSPORTATION IMPACTS

The construction phase of Alternative 2 would be over three years, or approximately 37 months. This alternative would consist of closing the bridge to vehicular traffic for approximately two years during that period, requiring traffic to direct to the Coggeshall Street or I-95 bridges approximately one mile to the north. One of the two existing navigational channels would be open for most of the construction duration. However, navigational closures would be required during three long-weekends with one during the first year of construction (month 10), and two long weekends during the third year of construction (month 32 and 33).

CONTRUCTION PHASE IMPACTS TO ABUTTING LAND OWNERS/BUSINESSES

The construction phase of each long-term alternative has the potential to impact area businesses due to the change in access during that period, however, like the other bascule (standard) bridge (Alternative 2W), the impacts for this alternative are much greater due to the lengthy roadway closure required. The construction phase of Alternative 2 would be over three years and would require the closure of all traffic lanes for approximately two years. Since most of the work would occur within the existing ROW or within the channels, direct impacts to area businesses are not anticipated.

The extended three-year construction duration and associated two-year roadway closure would likely affect certain businesses on Pope's Island and Fish Island that rely heavily on pass-by traffic or easy access. Businesses that would most likely be impacted by the extended construction include:

- Fathoms Restaurant;
- Bob's Sea and Ski Outdoor Sports;

- Worley Beds Factory Outlet;
- Dunkin' Donuts; and
- Fairhaven Hardware.

Since the construction impacts are considered indirect, caused by a change in access versus a direct impact to business operations, the extent of the impact would depend specifically on each business's market and customer base.

4.6 ALTERNATIVE 2W: WIDE DOUBLE-LEAF BASCULE BRIDGE

This section provides an evaluation of Alternative 2W: Wide Double-leaf Bascule Bridge consistent with the evaluation criteria established at the initiation of the study. The evaluation criteria are specific measures of effectiveness used to assess benefits and impacts of each alternative.

During the review of impacts of the preliminary set of long-term alternatives, the study team developed Alternative 2W to address the potential navigational clearance needs of changing uses in the North Harbor. Compared to Alternative 2 that provides 150 feet of horizontal clearance, Alternative 2W provides 200 feet of navigational clearance. Both Alternative 2 and Alternative 2W provide unlimited air draft. Due to the similarity, Figures 4.4 and 4.5 can be used for visual reference of Alternative 2W.

4.6.1 Bridge Operations

MINUTES PER BRIDGE CLOSURE

The opening sequence of the bridge in all of the long-term alternatives, including Alternative 2, would continue to follow the AASHTO recommendation that requires approximately four minutes to open and an additional four minutes to close. The average time to open and close the bridge will continue to vary based on the marine traffic transit time and the time required to clear pedestrians and vehicles from the movable span before it can open to marine traffic. The minutes per bridge closure in Alternative 2 is the same as the current condition.

FEET OF VERTICAL CLEARANCE (OPEN & CLOSED)

The Alternative 2 bridge would be designed to have a vertical clearance of 14 feet above MHW when the bridge is in the closed position. The bridge would create no vertical clearance restrictions when the bridge is open to marine traffic.

FEET OF HORIZONTAL CLEARANCE

The Alternative 2W bridge would include approximately 220 feet of navigational clearance. The bridge would be aligned so that the eastern bridge abutment is in approximately the same location as the existing eastern abutment, with the western abutment about 150 feet to the west, or in the location of the existing west channel.

NUMBER OF DAILY BRIDGE OPENINGS

As described in the No Build Alternative, the bridge currently operates on a fixed schedule each day. For all of the long-term alternatives, including Alternative 2, the schedule and number of daily bridge openings are expected to stay the same.

LONG-TERM RELIABILITY RISK

Since each moveable bridge includes a complex interaction of mechanical, electrical and structural components, there is an inherent risk in a moveable bridge that one of these systems will not operate as designed on any particular day and result in the inability for the bridge to open or close. Some moveable bridge types are at greater risk of inoperability than others due to the nature of their design and the conditions and environment that they operate within. As inoperability of a bridge for a period of time results in community and economic impacts, the risk associated with bridge reliability in the long-term was assessed. This included a general assessment of existing bridges of the type and size under consideration in conditions similar to that of New Bedford Harbor and their ability to remain reliable throughout the life span of the bridge. As noted, all moveable bridges are complex and have some long-term reliability risk. The span width and length of a new bascule bridge (Alternative 2W) when operating in the marine costal environment of New Bedford Harbor is estimated to have a medium level of risk. It is likely that even with regular maintenance, the bridge would experience some periods of unanticipated inoperability similar to any moveable bridge in the same location.

4.6.2 Transportation Impacts & Mobility Analysis

The evaluation and assessment of mobility along the corridor between County Street in New Bedford and Adams Street in Fairhaven is an important component of this study. Like of the long-term alternatives, Alternative 2W will not change vehicular traffic along the corridor. Unlike the No Build Alternative, Alternative 2W will provide additional pedestrian and bicycle facilities.

CORRIDOR INTERSECTION LOS, V/C RATIO, QUEUE LENGTHS & ROADWAY TRAVEL TIME/DELAY

As noted in the No Build Alternative analysis, none of the long-term alternatives, including Alternative 2W, will change result in changes to vehicular traffic along the corridor as compared to the 2035 No Build Condition described in Chapter 2. Each of the long-term alternatives being considered will result in the same number of bridge openings and the bridge will, on average, be open for the same duration. Therefore, the mobility analysis described previously in Section 4.2.2 related to the No Build Alternative is consistent with the results of intersection LOS, volume to capacity ratio, queue lengths, and travel time and delay analysis for Alternative 2W.

BICYCLE & PEDESTRIAN MOBILITY/CONNECTIVITY

The width of the existing swing span allows for five-foot-wide sidewalks on both the north and south sides and the roadway shoulders less than two feet in width. The rest of the corridor has a slightly wider ROW, but it is still not wide enough to accommodate five-foot-wide bike lanes. Consequently, bicyclists and pedestrians both use the sidewalks along the bridge corridor segment.

Most pedestrian/bicycle use of the bridge occurs on the southern sidewalk since this sidewalk directly connects to the New Bedford downtown and waterfront. A new pedestrian ramp was completed in 2014 as part of a new roadway ramp from northbound Route 18 to eastbound Route 6. Between the New Bedford and Fairhaven shorelines, pedestrian and bicycle connectivity is difficult due to a lack of secure crossings, ramps, and gaps in the sidewalk network.

Because of these access challenges and safety concerns, pedestrian and bicyclist use of the bridge is currently limited. During the peak hour counts conducted for the study, only one pedestrian was observed to walk the entire length of the bridge between New Bedford and Fairhaven. During the warmer months, it is understood that pedestrian and bicycle use is more frequent and increases during non-peak auto hours.

Like all of the build alternatives, Alternative 2W allows for a wider bridge with a 64-foot-wide ROW. This bridge width allows for the construction of four 11-foot-wide vehicular travel lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. However, while Alternative 2 provides improved facilities compared to the No Build Alternative, the delay for bicyclists and pedestrians will not change as it is controlled by the frequency and duration of bridge openings, which will not change from the current condition.

4.6.3 Safety

Improving roadway, pedestrian, bicycle, and marine safety, reducing conflicts between transportation modes, and increasing emergency vehicle access are important considerations for evaluating the long-term alternatives. This section provides an overview of the key safety concerns that will be addressed by Alternative 2W.

CONFORMANCE WITH AASHTO AND MASSDOT STANDARDS

For a bridge and approach roadway to be safe for vehicular traffic, it must be geometrically adequate. This consideration takes into account the number of lanes, lane and shoulder widths, approach roadway widths, horizontal clearances to roadside obstacles, stopping sight distances, vertical clearances and more. The standards for these criteria are identified in the AASHTO *Policy on Geometric Design of Highways and Streets* and the MassDOT *Project Development and Design Guidebook* (2006). Alternative 2 will conform to these standards with no known variance required.

DELAY TO EMERGENCY VEHICLE ACCESS

Both New Bedford and Fairhaven provide fire and emergency services to their respective municipalities. In case of bridge closure, Pope's Island can receive service from Fairhaven via the East Bridge. St. Luke's Hospital in New Bedford is the only facility in the two municipalities that provides emergency services. Bridge closures can affect Emergency Medical Services (EMS) access to the hospital from Fairhaven. Alternative 2W will not affect the level of access or potential for delay of emergency vehicles compared to the No Build Alternative.

IMPACT TO HIGH VOLUME BICYCLE AND PEDESTRIAN LOCATIONS

A sidewalk runs along the entire length of the north and south sides of the Route 6 Corridor between MacArthur Drive in New Bedford and Middle Street in Fairhaven. When the current roadway construction is completed in 2015, the roadway shoulders will be widened by reducing the vehicular travel lane width. In Alternative 2W, the new bridge cross section will include both widened roadway shoulders and sidewalks. However, even though Alternative 2W provides additional pedestrian and bicycle facilities, high pedestrian or bicycle volumes are not seen on the bridge and are not anticipated in the future. Alternative 2W will have no impact to high volume bicycle or pedestrian locations.

IMPACT TO SAFE NAVIGATION

Due to the existing navigational width of the channels at the existing bridge, safe vessel navigation through the bridge is a serious concern and a significant constraint to the North Harbor. Concerns for safe navigation have resulted in vessel limitations, which have resulted in delays and additional costs for commercial vessels.

Navigation through the bridges 94- and 95-foot-wide channels is the primary concern for large commercial vessels. These vessels generally employ harbor tugs for ship assist when maneuvering through the harbor and the bridge. Even with the tugs, limitations are still in place for transiting through the bridge. These include wind speed, visibility, and daylight.

- Wind speed is the primary concern that limits vessels ability to pass through the bridge. In all cases, if the wind exceeds 25 knots, no large vessel will transit the bridge. If the vessel is over 400 feet in length, this may be reduced to as little as 12 knots given the direction and based on the pilot's discretion.
- No vessel will transit through the bridge if the visibility is less than one nautical mile. Although large vessels don't enter the harbor though the hurricane barrier if visibility is limited, changes in visibility can occur rapidly in the harbor due to fog or heavy precipitation.
- Vessels greater than 500 feet in length or over 80 feet in width transit through the bridge and hurricane barrier in daylight only.

When transiting the current bridge, there is limited room for larger vessels to maneuver, especially north of the bridge between Fish Island and Pope's Island. Vessels approach slowly and then increase speed as they enter the bridge opening to ensure that they can exercise better

control of the vessel through the passage. The limited maneuvering space on either side of the bridge is complicated by the fact that typically ships approach the bridge on an angle due to slow approach speeds. This angle further reduces any free space between the vessel and the bridge as the vessel is moving through. The swing span's central pivot point, associated piers, and fendering system are located approximately in the center of the federal deep-water channel. This makes the bridge, in the perspective of the pilots, the most vulnerable navigation safety area in the harbor.

When larger ships head northbound through the bridge, limited space is available for stopping or maneuvering once they pass the bridge. Generally, two tugs are employed; one at the bow and one at the stern, but only one can assist once the vessel is in the bridge opening due to the width of the channel. The forward tug goes through the bridge first and can come back alongside once the bow clears. Proceeding northbound, once the vessel passes through the bridge and enters the basin, it must slow and stop before being maneuvered into a berth.

Generally, vessels do not require tugs on transiting southbound. When departing southbound, the vessel leaves the berth and turns in the basin in a manner that allows it to line up with the west channel that is used most of the time. Once lined up, it transits the opening and maintains its alignment with the federal deep-water channel.

While the No Build Alternative does not provide any change from the existing condition, Alternative 2W will result in significant improvements to safe navigation through the bridge. The 220 feet of horizontal clearance would mitigate many of the safe navigation concerns, most notably the wind restriction, which has a significant impact on vessel delay. The wider clearance would allow for full tug assistance throughout the bridge transit and would also minimize the impact of the limited maneuverable space in the North Harbor, which will not change as a result of the project.

DELAY TO EMERGENCY MARINE ACCESS

Currently, the swing span impedes emergency vessel access in cases where there is an emergency in the North Harbor since the bridge must open to allow municipal police, fire and rescue, harbormaster, or other emergency response vessels to transit the bridge.
The design of Alternative 2W allows for a vertical clearance of 14 feet in the down (closed) position. This is sufficient clearance for all but the largest emergency response vessels to fit under the bridge without the need to wait for a bridge opening. This would eliminate most of the delay to emergency response currently experienced due to the bridge.

4.6.4 Environment

The following section presents the potential for impacts to the natural environment from Alternative 2W. Compared to the No Build Alternative, Alternative 2W has more potential to impact coastal, wetland, and natural resources due to the required in-water construction. The following sections provide a screening-level assessment, therefore additional and more in-depth analyses of resource impacts would be required, per the National Environmental Policy Act

(NEPA) and the Massachusetts Environmental Policy Act (MEPA), as the designs for the bridge progress.

IMPACT TO COASTAL RESOURCES

Coastal Zone Impacts

The New Bedford-Fairhaven Bridge is located within the designated coastal zone of the Commonwealth of Massachusetts; therefore, this project may be subject to a federal consistency review to ensure that the proposed project would be consistent with the enforceable policies of the federally approved coastal management program of the Commonwealth.

The construction required to raise the elevation of the approach on Fish Island under Alternative 2W has the potential to affect Chapter 91 Tidelands located on the eastern side of the island. A Chapter 91 Waterways authorization from the Massachusetts Department of Environmental Protection (MassDEP) may be required for the construction of new bridge structure.

Within its policy documents, the Massachusetts Office of Coastal Zone Management (CZM) strongly encourages early coordination with the agency to determine the appropriate level of coastal review that would be required for projects. Coordination with CZM should be undertaken during any future NEPA and MEPA phases of the project.

Floodplains

The proposed bridge would be located within the 100-year floodplain. Alternative 2W would require the construction of permanent foundations for the bascule piers to be constructed within the water, potentially affecting the 100-year floodplain and flood levels within this area. As the design for the bridge progresses, there is the opportunity to limit the size of the foundations, thereby minimizing impacts. Flooding and construction within the 100-year floodplain is under the jurisdiction of CZM; therefore, coordination with CZM would be needed in future phases of the project to determine the extent of potential impacts to the 100-year floodplain and the applicability of coastal hazard policies to this project.

Hazardous and Contaminated Materials

New Bedford Harbor has been designated as a Superfund Site and is currently undergoing an extensive clean-up effort by the EPA. Alternative 2W would require a substantial amount of in-water construction work. As part of the construction, contaminated soil/sediment from New Bedford Harbor would need to be removed so that new bascule piers could be constructed. These structures would be at least 24 feet by 64 feet and would require a significant amount of soil disturbance below the water line. In-water soil/sediment disturbance would also be expected from the removal of the existing swing span center pier structure. Therefore, Alternative 2 has the potential to result in impacts from the existing contaminated harbor sediments, greater than those potential impacts anticipated for most of the other long-term alternatives.

As any designs for the bridge progress, coordination would be undertaken with the EPA and the MassDEP to determine the amount of disturbance anticipated during construction, options for mitigation and minimization, and for the appropriate disposal of the contaminated sediments.

IMPACT TO WETLAND RESOURCES

A small area of rocky intertidal wetlands is located on the western shore of Pope's Island. Temporary disturbance resulting from the construction of Alternative 2W may potentially affect this wetland type. Additional field verification of this wetland type, as well as consultation with the USACE and MassDEP, would be needed in future phases of this project to determine the extent of this resource.

Potential impacts to water quality may occur from the disturbance and removal of contaminated sediments from New Bedford-Fairhaven Harbor during construction. Coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination.

Proper erosion and sedimentation controls, as well as stormwater pollution prevention best management practices (BMPs), would be implemented during the construction phase to prevent or avoid any potential impacts to the wetlands and aquatic species known to reside within them. Examples of BMPs include silt fencing, biotubes, and regulated construction entrances. Consultation with USACE and MassDEP regarding avoidance and minimization of potential impacts as well as permitting requirements should be undertaken during any future phases of this project.

As project development progresses, special consideration should be given to the location of construction staging areas on Pope's Island. Coastal bank bluff and sea cliff wetlands form the southern shores of Pope's Island and the placement of construction staging areas within or adjacent to these wetlands should be avoided.

IMPACT TO NATURAL RESOURCES

Alternative 2W would not result in any impacts to Areas of Critical Environmental Concern (ACEC), prime farmland soils, or aquifers. Alternative 2W has the potential for greater impacts to water quality, shellfish and fish habitat, and priority habitats than the No Build Alternative.

Water Quality

Alternative 2W would require a substantial amount of in-water construction work. As part of the construction, contaminated soil/sediment from New Bedford-Fairhaven Harbor would need to be removed so that new bascule piers could be constructed. These structures would be at least 24 feet by 64 feet and would require a significant amount of soil disturbance below the water line. Therefore, the potential for impacts to water quality from Alternative 2W would be greater than the No Build Alternative and most of the build alternatives. Potential impacts from the in-water soil/sediment disturbance from the removal of the existing swing span center pier structure would be the same as the other build alternatives, but greater than the No Build Alternative.

Similar to the other long-term alternatives, coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination. Additionally, proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to water quality from construction activities.

Shellfish and Fish Habitat

Due to the substantial in-water construction that would be required, the construction of Alternative 2W would have the potential to result in greater temporary impacts to shellfish and fish habitats than the No Build Alternative. Similar to the other long-term alternatives, coordination may be needed with MassDEP to ensure that construction activities do not disrupt active shellfish spawning grounds. Proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to shellfish and fish habitats from construction activities.

Although the consumption of fish and shellfish caught in the New Bedford Inner Harbor is regulated by the Massachusetts Department of Public Health (MDPH), consultation with the National Oceanographic Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) should be undertaken during future phases of this project to determine the presence of Essential Fish Habitats (EFH) within New Bedford-Fairhaven Harbor.

Priority Habitats

Alternative 2 is not anticipated to impact priority plant or animal habitats. However, additional field verification and/or consultation with the U.S. Fish and Wildlife Service (USFWS) and MassDEP may be required in future phases of the project to verify the presence of state and federally listed plant and animal species and habitats.

IMPACTS TO AIR QUALITY AND GREENHOUSE GASES FROM IDLING VEHICLES

None of the long-term alternatives, including the No Build Alternative, would increase traffic volumes on the corridor as compared to the 2035 No Build Condition described in Chapter 2. The number of bridge openings would remain the same. Consequently, none of the long-build alternatives has the potential to worsen air quality compared to the 2035 No Build Condition. In future phases of the project, a formal air quality evaluation (microscale or mesoscale) would be required to determine the proposed project's impacts as compared to the National Ambient Air Quality Standards (NAAQS).

In Alternative 2W, the addition of bicycle and pedestrian facilities along the Route 6 Corridor, including along a new movable span, may have the potential for localized air quality benefits. The addition of these facilities has the potential to shift some motorists to non-motorized modes, potentially reducing the number of idling cars at bridge openings.

Potential temporary impacts to air quality would be anticipated from construction activities. BMPs would be implemented during construction to minimize vehicle emissions and manage fugitive dust. Typical air quality mitigation measures implemented during construction could include dust suppression and control methods to minimize fugitive dust on dry and windy days.

IMPACTS FROM NOISE

Since traffic volumes are not anticipated to increase substantially over existing levels, Alternative 2W is not anticipated to result in noise impacts to nearby noise-sensitive receptors. However, a formal noise assessment in compliance with the FHWA would be required in any future phases of this project.

Potential temporary noise impacts would result from construction activities and the operation of construction equipment. BMPs would be implemented during construction to mitigate potential noise impacts (particularly during non-daytime hours).

4.6.5 Land Use & Economic Development

The following section provides analysis regarding the impacts on businesses, including property acquisition to accommodate bridge construction. Additionally, potential economic benefits of Alternative 2W, such as shipper cost savings, are evaluated.

NUMBER/VALUE OF BUSINESSES & JOBS PERMANENTLY IMPACTED

The design of the Alternative 2W bridge utilizes primarily the same footprint as the existing swing span and will not require the acquisition of any additional property or ROW. Furthermore, the operation of the new moveable span will not vary dramatically in a way that would functionally affect the operation of area businesses and would not result in the reduction of the number of jobs. With absence of physical ROW changes and business operational impacts, no business or related property impacts or acquisition is anticipated due to physical or functional impacts.

SHIPPER COST SAVINGS

A variety of both landside and maritime benefits were considered to assess the economic benefits of the long-term build alternatives, including Alternative 2W. While some may be quantified, others are more difficult to count and therefore the analysis considered both quantitative and qualitative benefits.

As a first step in the assessment, the potential benefits that could be generated by a new bridge were inventoried. In similar projects, automobile and truck benefits are often included, such as reduced travel time, vehicle operating cost savings, and emissions reduction, among others. On the marine side, moveable bridge improvements can affect shipper costs, travel time, and similar factors.

A thorough review of potential benefits indicated few differences between the 2035 No Build Condition and Alternative 2W in terms of quantifiable benefits. This is due to the relatively small variation between the proposed alternatives and the existing condition in most aspects of transportation. The lack of impact to existing and future traffic conditions results in no benefits from reduced travel time, vehicle operating cost savings, and emissions reduction. However, the change in horizontal clearance for vessels between the existing bridge and Alternative 2W is a significant change. The existing bridge provides a maximum horizontal clearance of 95 feet, while the horizontal clearance for Alternative 2W is 220 feet. Alternative 2W has no limitations on the vertical clearance of vessels.

This analysis only considers the benefits directly related to the bridge, an approach consistent with USDOT benefit-cost analysis guidance. While there is potential for additional economic development at the North Terminal and in the North Harbor, the chosen bridge alternative is only one component of that potential growth. As a result, it would be disingenuous to attribute that economic development potential *exclusively* to the new bridge. Additionally, when looking for the true differences between bridge alternatives, it is important to examine only the benefits associated directly with the bridge.

Landside Benefits

Traditional benefits associated with bridge improvements include both landside and maritime components. In the case of the proposed alternatives, no landside impacts were found. Each of the alternatives maintains the same bridge opening duration and creates no difference in general vehicular, bicycle, or pedestrian traffic operations. In other words, an automobile driver who uses the bridge today would discern no improvement in travel time, or achieve any other transportation related benefits, with a new bridge. Similarly, pedestrian and bicycle traffic would observe no change in their travel time.

It is important to note that the duration and methods for construction may cause various delay or diversion impacts during the construction period. However, no impact was quantified as the transportation analysis showed no discernable diversion patterns that could be analyzed. The construction phase impacts will include a limited road closure while the bridge is being installed along with lane closures for the duration of the construction. It is anticipated that during bridge closures, detours and notifications by area ITS systems will be provided to minimize impacts to drivers. While the impacts cannot easily be quantified, it should be noted that the longer closures will have a greater potential for detrimental impacts to local businesses and diversion costs for roadway users.

Since it was determined that the bridge improvement would have minimal or no impact on long-term landside traffic and pedestrian patterns, no landside benefits were quantified or included in the benefits analysis.

Maritime Benefits

A series of interviews were held with maritime users to determine how the current bridge affects their operations and to identify the ways in which a new bridge could positively affect them. As discussed in Chapter 2, wind and its impact on the navigability through the bridge opening is a critical issue facing maritime users. For this analysis, maritime benefits are primarily due to a reduction in shipper costs associated with delays within New Bedford Harbor. Changes in the use of tugs with Alternative 2W were also considered as a potential benefit. Discussions with maritime experts indicated the tugs used are "ship assist" tugs that primarily aid with alignment to the berth. Accordingly, they will still be required for all large cargo vessels that berth in the North Harbor regardless of the selected alternative and no change to tug costs will occur for larger vessels.

The greatest difference between the No Build Alternative, which retains the existing clearance, and the build alternatives is the horizontal navigational clearance. The No Build Alternative maintains the 95 feet of horizontal navigational clearance, which creates issues for the large vessels that enter the North Harbor. When there are high winds, these vessels cannot transit the bridge until the wind speeds are lower, as there is not enough clearance to pass safely through in high wind conditions.

With Alternative 2W, the horizontal navigational width would be 220 feet. This width would remove the need for larger vessels to remain moored south of the bridge should high winds prevail. In the past year, three of the 12 vessels were delayed for one day during their trip to New Bedford due to the existing bridge constraint. It is understood that each day of delay costs the shipper $40,000. Under existing conditions, approximately 25 percent of vessels are delayed for a full day, costing shippers a total of $120,000 per year. With Alternative 2W, no ships would experience delay, which results in an average savings of $120,000 per year in shipper costs. Assuming that users of the harbor factor into their overall decision-making the potential cost of delay, the wider horizontal clearance would reduce the general cost of using the harbor.

Historically, up to 30 vessels have called upon the port in a single year. This is considered a reasonable upper limit, based on interviews conducted with key maritime users. Assuming that the bridge improvement induces vessel calls to meet this historic high, benefits associated with a reduction in delay time would be generated. These new vessels, however, are not currently using the Port of New Bedford. Rather, they are a projection of potential. As a result, and consistent with economic consumer surplus theory, the benefit they receive would be half of the benefit to existing users.

The change from 12 to 30 trips represents a portion of all potential vessels that did not use the Port of New Bedford under the existing conditions, but that would be "attracted" to New Bedford because the risk of delay and associated costs are mitigated with the wider horizontal clearance. The benefits to these additional vessels are estimated using the "rule of one-half," indicating the change in consumer surplus associated with the removal of the risk of delay. In a future year with 30 total vessels, this would result in a benefit of $20,000 per vessel for the 18 additional vessels, or a total of $360,000.

Summary of Benefits

Table 4.20 summarizes the average annual benefits associated with Alternative 2W as compared to the current conditions that would be maintained under the No Build Alternative. As discussed above, no landside benefits were identified or quantified. Additionally, there would be no change in the number of tugs that would be required, so the total costs would remain the same. The benefits generated by any of the new bridge alternatives is estimated to be $480,000 with delay costs representing $120,000 and savings to new cargo vessels $360,000.

Table 4.20. Average Single-Year Benefits of Bridge Replacement Alternatives

Benefit Category	Annual Savings (2015$)
Landside Transportation Savings	$0
Delay Cost Savings	$120,000
Savings to New Cargo Vessels	$360,000
Change in Tug Costs	$0
Total Benefits	$480,000

4.6.6 Community

The impacts to community resources, such as open space, recreational areas, or historic or cultural resources were also evaluated for Alternative 2W. Additionally, access to businesses along the corridor and impacts to Environmental Justice (EJ) populations were evaluated. The study team also considered the visual impacts of a new bridge structure.

IMPACT TO PROTECTED AND RECREATIONAL OPEN SPACE

Alternative 2W would not result in any impacts to protected and/or recreational open space. An evaluation of publicly owned parklands, per Section 4(f) of the Department of Transportation Act of 1966, would be required for any future phases of this project.

As the project development phase continues and the designs for the bridge progresses, special consideration should be given to the location of construction staging areas. Marine Park on Pope's Island is owned and operated by the City of New Bedford and occupies the southern half of the island, but should not be used for construction staging.

IMPACT TO CULTURAL/HISTORIC/ARCHEOLOGICAL RESOURCES

Under Alternative 2W, the middle bridge's swing span of the National Register-eligible New Bedford-Fairhaven Bridge would be replaced with a new double-leaf bascule bridge. The loss of the swing span would diminish the integrity of this historic property.

In addition to direct effects to the New Bedford-Fairhaven Bridge, there is the potential for indirect visual effects to historic properties that lie within the larger study area. A portion of the through truss of the existing swing span is visible as a component of the urban/industrial landscape from both the Schooner Ernestina, located on the New Bedford waterfront, and buildings that lie along the eastern edge of the New Bedford Historic District (see Figure 2.11). Both the Schooner Ernestina and the New Bedford Historic District are National Historic Landmarks. Due to the lack of a truss and thus the lower profile of the bridge, it is unlikely that the new bridge would be visible when in the closed position. It would be visible from the New Bedford Historic District and the Schooner Ernestina when in the open (up) position, as the top of the bridge would extend approximately 63 feet higher than the top of the existing truss when measured from the water. While the replacement of the swing span through truss with a double-leaf bascule span would alter the visual setting of these two historic properties, it is not anticipated that this would adversely affect these resources given both the distance between the properties and the bridge, and the visual complexity of the viewshed.

Regardless of which long-term alternative is selected, FHWA will need to initiate consultation with the MHC in accordance with Section 106 of the National Historic Preservation Act. Consultation should also be undertaken with the New Bedford and Fairhaven Historical Commissions. Through this consultation, additional historic properties that may be eligible for, but are not yet listed in, the National Register of Historic Places will be identified. The potential for effects to archeological resources will also be determined. FHWA, working together with the MHC, will seek ways to avoid, minimize, or mitigate adverse effects beyond the HAER documentation that has already been completed. In addition to consultation under Section 106, the preparation of a programmatic 4(f) evaluation, in compliance with the U.S. Department of Transportation Act of 1966, will be required.

IMPACT TO BUSINESS ACCESS

The parcels surrounding the approaches to the middle bridge include the following businesses:

- Bridge Shoppes shopping center;
- Captain Leroy's marina;
- Maritime Terminals facility;
- AGM Marine Contractors, Inc.; and
- Tucker Roy Marin Towing and Salvage.

Alternative 2W does not include any modifications to the bridge approaches and utilizes the existing footprint. The horizontal alignment of the road and access to abutting properties will remain the same.

IMPACT TO ENVIRONMENTAL JUSTICE POPULATIONS

The locations of Environmental Justice (EJ) populations were identified in Chapter 2. Some EJ populations reside in neighborhoods that abut or are adjacent to the New Bedford-Fairhaven Bridge. Residential clusters of EJ populations reside at the western edge of the local study area in New Bedford and EJ populations (low-income) also reside throughout the local study area within Fairhaven. Consequently, an evaluation of the potential for disproportionately high and adverse human health or environmental effects of the project alternatives on minority populations and low-income populations, per *Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, would be required in future phases of the project to comply with NEPA and MEPA.

Bicycle and pedestrian improvements in Alternative 2W have the potential to substantially improve the ability of EJ populations, who may not own or have access to automobiles, to get across the bridge to access employment or other key destinations. The greatest potential for impacts to EJ populations would occur during construction. Under Alternative 2W, the construction phase would be approximately three years long. The bridge would be closed to vehicular, bicycle, and pedestrian traffic for two years. No transit service currently operates across the bridge.

Alternative 2W also has the potential to result in other temporary construction impacts to the EJ populations located in close proximity to the proposed bridge. Potential impacts could include noise, glare, fumes, and dust from construction equipment as well as changes in traffic patterns and access to businesses due to the movement of construction vehicles. Potential construction period impacts would be mitigated with BMPs for construction activities including those used to minimize dust, noise, maintenance, and protection of traffic plans, and limiting the hours of construction. Further analyses under NEPA and MEPA would be required to determine if construction-related impacts would be disproportionately higher on low-income and minority populations.
Alternative 2W, along with all of the long-term build alternatives, has the same proportion of impacts to EJ populations compared to non-EJ populations.

VISUAL IMPACTS

The visual impacts from Alternative 2 would be limited. When the bridge is in the down position, it would look similar to the fixed spans of the east and west bridges. However, when the bridge is in the up (or open) position the bridge leafs would extend approximately 110 feet above the roadway surface or 130 feet above MHW. This is approximately 40 feet higher than the top of the existing truss. Although the bridge would be visible from a greater distance while in the up position, the topography and the significant development that surrounds the harbor would shield the view of the bridge from most locations. Figures 4.4 and 4.5 provide simulated renderings of what the bridge would look like if standing at Captain Leroy's on Pope's Island

4.6.7 Alternative Feasibility

The identification of the costs, construction phase impacts, and permanent ROW impacts provide a critical way to evaluate the feasibility of an alternative. This section describes the capital costs, operating and maintenance costs, the construction methodology, a description of impacts to marine and vehicular traffic during construction, and permanent impacts to adjoining properties or businesses.

CAPITAL COST

The estimated cost for Alternative 2W is between $130 and $160 million. This capital cost would include the bridge design and permitting, removal and demolition of the existing swing span and construction of the new bridge. The limits of construction would be generally limited to the 289-foot length of the existing swing span with modifications to the approach spans limited to raising the approaches to provide the necessary under bridge clearances. It is estimated that this work would all be done utilizing the existing piers and newly reconstructed pier caps. It is assumed that dredging and disturbance of the harbor sediments would be limited to construction of the tower structures and fendering system and removal of the existing swing span center pier structure. A more detailed cost estimate would be developed as additional information regarding subsurface conditions, bridge specifications, and design details are developed through the project development process.

OPERATING AND MAINTENANCE COSTS

Upon completion of construction, Alternative 2W will require both routine maintenance and daily operating costs. Table 4.21 provides the estimated annual costs required to operate and maintain the bridge, which are the same as the other double-leaf alternatives that have two mechanical units to operate and maintain.

Table 4.21. Alternative 2W Annual Operating and Maintenance Costs

Operating Costs	Type	Annual Cost (2015$)
Operating Cost	Electricity utility	$ 100,000
Operating Cost	Stand by generator	$ 2,600
Operating Cost	Bridge operators	$300,000
Routine Maintenance	Monthly bridge lubrication	$ 27,600
Routine Maintenance	Replace lamps	$ 1,500
Routine Maintenance	Replace gate arms	$ 18,000
Routine Maintenance	Miscellaneous minor repairs	$ 20,000
Routine Maintenance	Guard rail repairs	$ 20,000
	TOTAL	$ 489,700

In addition, the annual operating and maintenance costs identified above, Alternative 2W will require major repairs to be conducted on a regular basis to maintain the bridge in a state of good repair and ensure its on-going utility. The schedule of major repairs included in Table 4.22 is an estimate of repairs that is typical for bascule bridges in similar environments. Over a 50-year span, it should be anticipated that approximately $14.6 million worth of repairs (in 2015 dollars) will be required.

CONSTRUCTION PHASE TRANSPORTATION IMPACTS

The construction phase of Alternative 2W would be over three years, or approximately 37 months. This alternative would consist of closing the bridge to vehicular traffic for approximately two years during that period, requiring traffic to direct to the Coggeshall Street or I-95 bridges approximately one mile to the north. One of the two existing navigational channels would be open for most of the construction duration. However, navigational closures would be required during three long-weekends with one during the first year of construction (month 10), and two long weekends during the third year of construction (month 32 and 33).

Table 4.22. Alternative 2W Schedule of Major Repairs

Year	Work Performed	Cost (2015$)
10	Fender repairs	$ 250,000
15	Minor Structural repairs Deck repairs	$ 1,250,000 $ 250,000
25	Electrical control repairs Minor structural repairs Fender repair Control house repairs	$ 700,000 $ 1,250,000 $ 250,000 $ 100,000
30	Deck repairs	$ 250,000
35	Replace traffic gates Electrical system rehabilitation Structural rehabilitation Substructure repairs	$ 300,000 $ 2,000,000 $ 3,500,000 $1,000,000
40	Fender repairs Machinery rehabilitation	$ 250,000 $3,000,000
45	Deck repairs	$ 250,000
	TOTAL	$14,600,000

CONTRUCTION PHASE IMPACTS TO ABUTTING LAND OWNERS/BUSINESSES

The construction phase of each long-term alternative has the potential to impact area businesses due to the change in access during that period, however, like Alternative 2, the impacts for this alternative are much greater due to the lengthy roadway closure required. The construction phase of Alternative 2W would be over three years and would require the closure of all traffic lanes for approximately two years. Since most of the work would occur within the existing ROW or within the channels, direct impacts to area businesses are not anticipated.

The extended three-year construction duration and associated two-year roadway closure would likely affect certain businesses on Pope's Island and Fish Island that rely heavily on pass-by traffic or easy access. Businesses that would most likely be impacted by the extended construction include:

- Fathoms Restaurant;
- Bob's Sea and Ski Outdoor Sports;
- Worley Beds Factory Outlet;
- Dunkin' Donuts; and
- Fairhaven Hardware.

Since the construction impacts are considered indirect, caused by a change in access versus a direct impact to business operations, the extent of the impact would depend specifically on each business's market and customer base.

4.7 ALTERNATIVE 3: SINGLE-LEAF ROLLING BASCULE BRIDGE

This section provides an evaluation of Alternative 3: Single-leaf Rolling Bascule Bridge consistent with the evaluation criteria established at the initiation of the study. The evaluation criteria are specific measures of effectiveness used to assess benefits and impacts of each alternative.

Alternative 3 is a single-leaf rolling bascule bridge that provides 150 feet of navigational clearance and unlimited air draft. The bridge profile includes a truss structure, similar to the existing bridge structure, located above the roadway. In addition, a counterweight would be located above the truss structure. Figures 4.6 and 4.7 provide simulated renderings for what Alternative 2 would look like if standing at Captain Leroy's marina on Pope's Island. Figure 4.6 shows the bridge in the closed position (open for vehicular traffic). Figure 4.7 shows the bridge in the open position (closed for vehicular traffic).

Figure 4.6. Alternative 3: Single-leaf Rolling Bascule Bridge in Closed Position

Figure 4.7. Alternative 3: Single-leaf Rolling Bascule Bridge in Open Position

4.7.1 Bridge Operations

MINUTES PER BRIDGE CLOSURE

The opening sequence of the bridge in all of the long-term alternatives, including Alternative 3, would continue to follow the AASHTO recommendation that requires approximately four minutes to open and an additional four minutes to close. The average time to open and close the bridge will continue to vary based on the marine traffic transit time and the time required to clear pedestrians and vehicles from the movable span before it can open to marine traffic. The minutes per bridge closure in Alternative 3 is the same as the current condition.

FEET OF VERTICAL CLEARANCE

The Alternative 3 bridge would be designed to have a vertical clearance of 14 feet above MHW when the bridge is in the closed position. The bridge would create no vertical clearance restrictions when the bridge is open to marine traffic.

FEET OF HORIZONTAL CLEARANCE (OPEN & CLOSED)

The Alternative 3 bridge would include approximately 150 feet of navigational clearance. The bridge would be aligned so that the eastern bridge abutment is in approximately the same location as the existing eastern abutment, with the western abutment about 150 feet to the west, which is in the location of the existing west channel.

NUMBER OF DAILY BRIDGE OPENINGS

As described in the No Build Alternative, the bridge currently operates on a fixed schedule each day. For all of the long-term alternatives, including Alternative 3, the schedule and number of daily bridge openings are expected to stay the same.

LONG-TERM RELIABILITY RISK

Since each moveable bridge includes a complex interaction of mechanical, electrical and structural components, there is an inherent risk in a moveable bridge that one of these systems will not operate as designed on any particular day and result in the inability for the bridge to open or close. Some moveable bridge types are at greater risk of inoperability than others due to the nature of their design and the conditions and environment that they operate within. As inoperability of a bridge for a period of time results in community and economic impacts, the risk associated with bridge reliability in the long-term was assessed. This included a general assessment of existing bridges of the type and size under consideration in conditions similar to that of New Bedford Harbor and their ability to remain reliable throughout the life span of the bridge. As noted, all moveable bridges are complex and have some long-term reliability risk. It was estimated that a rolling bascule bridge with the span width and length of the New Bedford-Fairhaven Bridge when operating in the marine costal environment of New Bedford Harbor would have a high level of risk. Roadway bridges of similar size and type have had structural and corrosion issues that have created reliability issues and have caused the bridges to be shut down periodically. It is likely that even with regular maintenance, corrosion issues would regularly affect the operability of such a long and wide structure.

4.7.2 Transportation Impacts & Mobility Analysis

The evaluation and assessment of mobility along the corridor between County Street in New Bedford and Adams Street in Fairhaven is an important component of this study. Like of the long-term alternatives, Alternative 3 will not change vehicular traffic along the corridor. Unlike the No Build Alternative, Alternative 3 will provide additional pedestrian and bicycle facilities.

CORRIDOR INTERSECTION LOS, V/C RATIO, QUEUE LENGTHS & ROADWAY TRAVEL TIME/DELAY

As noted in the No Build Alternative analysis, none of the long-term alternatives, including Alternative 3, will change result in changes to vehicular traffic along the corridor as compared to the 2035 No Build Condition described in Chapter 2. Each of the long-term alternatives being considered will result in the same number of bridge openings and the bridge will, on average, be open for the same duration. Therefore, the mobility analysis described previously in Section

4.2.2 related to the No Build Alternative is consistent with the results of intersection LOS, volume to capacity ratio, queue lengths, and travel time and delay analysis for Alternative 3.

BICYCLE & PEDESTRIAN MOBILITY/CONNECTIVITY

The width of the existing swing span allows for five-foot-wide sidewalks on both the north and south sides and the roadway shoulders less than two feet in width. The rest of the corridor has a slightly wider right-of-way (ROW), but it is still not wide enough to accommodate five-foot-wide bike lanes. Consequently, bicyclists and pedestrians both use the sidewalks along the bridge corridor segment.

Most pedestrian/bicycle use of the bridge occurs on the southern sidewalk since this sidewalk directly connects to the New Bedford downtown and waterfront. A new pedestrian ramp was completed in 2014 as part of a new roadway ramp from northbound Route 18 to eastbound Route 6. Between the New Bedford and Fairhaven shorelines, pedestrian and bicycle connectivity is difficult due to a lack of secure crossings, ramps, and gaps in the sidewalk network.

Because of these access challenges and safety concerns, pedestrian and bicyclist use of the bridge is currently limited. During the peak hour counts conducted for the study, only one pedestrian was observed to walk the entire length of the bridge between New Bedford and Fairhaven. During the warmer months, it is understood that pedestrian and bicycle use is more frequent and increases during non-peak auto hours.

Like all of the build alternatives, Alternative 3 allows for a wider bridge with a 64-foot-wide ROW. This bridge width allows for the construction of four 11-foot-wide vehicular travel lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. However, while Alternative 3 provides improved facilities compared to the No Build Alternative, the delay for bicyclists and pedestrians will not change as it is controlled by the frequency and duration of bridge openings, which will not change from the current condition.

4.7.3 Safety

Improving roadway, pedestrian, bicycle, and marine safety, reducing conflicts between transportation modes, and increasing emergency vehicle access are important considerations for evaluating the long-term alternatives. This section provides an overview of the key safety concerns that will be addressed by Alternative 3.

CONFORMANCE WITH AASHTO AND MASSDOT STANDARDS

For a bridge and approach roadway to be safe for vehicular traffic, it must be geometrically adequate. This consideration takes into account the number of lanes, lane and shoulder widths, approach roadway widths, horizontal clearances to roadside obstacles, stopping sight distances, vertical clearances and more. The standards for these criteria are identified in the AASHTO *Policy on Geometric Design of Highways and Streets* and the MassDOT *Project Development and Design*

Guidebook (2006). Alternative 3 will conform to these standards with no known variance required.

DELAY TO EMERGENCY VEHICLE ACCESS

Both New Bedford and Fairhaven provide fire and emergency services to their respective municipalities. In case of bridge closure, Pope's Island can receive service from Fairhaven via the East Bridge. St. Luke's Hospital in New Bedford is the only facility in the two municipalities that provides emergency services. Bridge closures can affect Emergency Medical Services (EMS) access to the hospital from Fairhaven. Alternative 3 will not affect the level of access or potential for delay of emergency vehicles compared to the No Build Alternative.

IMPACT TO HIGH VOLUME BICYCLE AND PEDESTRIAN LOCATIONS

A sidewalk runs along the entire length of the north and south sides of the Route 6 Corridor between MacArthur Drive in New Bedford and Middle Street in Fairhaven. When the current roadway construction is completed in 2015, the roadway shoulders will be widened by reducing the vehicular travel lane width. In Alternative 3, the new bridge cross section will include both widened roadway shoulders and sidewalks. However, even though Alternative 3 provides additional pedestrian and bicycle facilities, high pedestrian or bicycle volumes are not seen on the bridge and are not anticipated in the future. Alternative 3 will have no impact to high volume bicycle or pedestrian locations.

IMPACT TO SAFE NAVIGATION

Due to the existing navigational width of the channels at the existing bridge, safe vessel navigation through the bridge is a serious concern and a significant constraint to the North Harbor. Concerns for safe navigation have resulted in vessel limitations, which have resulted in delays and additional costs for commercial vessels.

Navigation through the bridges 94- and 95-foot-wide channels is the primary concern for large commercial vessels. These vessels generally employ harbor tugs for ship assist when maneuvering through the harbor and the bridge. Even with the tugs, limitations are still in place for transiting through the bridge. These include wind speed, visibility, and daylight.

- Wind speed is the primary concern that limits vessels ability to pass through the bridge. In all cases, if the wind exceeds 25 knots, no large vessel will transit the bridge. If the vessel is over 400 feet in length, this may be reduced to as little as 12 knots given the direction and based on the pilot's discretion.
- No vessel will transit through the bridge if the visibility is less than one nautical mile. Although large vessels don't enter the harbor though the hurricane barrier if visibility is limited, changes in visibility can occur rapidly in the harbor due to fog or heavy precipitation.
- Vessels greater than 500 feet in length or over 80 feet in width transit through the bridge and hurricane barrier in daylight only.

When transiting the current bridge, there is limited room for larger vessels to maneuver, especially north of the bridge between Fish Island and Pope's Island. Vessels approach slowly and then increase speed as they enter the bridge opening to ensure that they can exercise better control of the vessel through the passage. The limited maneuvering space on either side of the bridge is complicated by the fact that typically ships approach the bridge on an angle due to slow approach speeds. This angle further reduces any free space between the vessel and the bridge as the vessel is moving through. The swing span's central pivot point, associated piers, and fendering system are located approximately in the center of the federal deep-water channel. This makes the bridge, in the perspective of the pilots, the most vulnerable navigation safety area in the harbor.

When larger ships head northbound through the bridge, limited space is available for stopping or maneuvering once they pass the bridge. Generally, two tugs are employed; one at the bow and one at the stern, but only one can assist once the vessel is in the bridge opening due to the width of the channel. The forward tug goes through the bridge first and can come back alongside once the bow clears. Proceeding northbound, once the vessel passes through the bridge and enters the basin, it must slow and stop before being maneuvered into a berth.

Generally, vessels do not require tugs on transiting southbound. When departing southbound, the vessel leaves the berth and turns in the basin in a manner that allows it to line up with the west channel that is used most of the time. Once lined up, it transits the opening and maintains its alignment with the federal deep-water channel.

While the No Build Alternative does not provide any change from the existing condition, Alternative 3 will result in improvements to safe navigation through the bridge. Operations of the large vessels transiting though the Alternative 3 bridge would not change dramatically from the No Build Condition due to limitations caused by visibility and daylight.

The 150-foot-wide clearance is considered the minimum acceptable width for safe navigation into the North Harbor. As noted two tugs are typically employed for large vessels; one at the bow and one at the stern, with only one able to assist once the vessel is in the bridge opening. This will remain the same for the Alternative 3 bridge. Additionally, the limited maneuvering space on either side of the bridge is complicated by the fact that typically ships approach the bridge on an angle due to slow approach speeds. This angle further reduces any free space between the vessel and the bridge as the vessel is moving through. With a 150-foot-wide navigational clearance the width would still be anticipated to be a concern for the larger ships.

To mitigate this concern, an enhanced fendering system is suggested for construction as part of the bridge. This would include "transit fenders where part of the maneuver involves laying the vessel alongside the fenders and moving forward along the fendering structure as you approach and pass through the bridge opening. This is similar to the system in the Panama Canal and is used effectively to assist in navigation.

DELAY TO EMERGENCY MARINE ACCESS

Currently, the swing span impedes emergency vessel access in cases where there is an emergency in the North Harbor since the bridge must open to allow municipal police, fire and rescue, harbormaster, or other emergency response vessels to transit the bridge.
The design of Alternative 3 allows for a vertical clearance of 14 feet in the down (closed) position. This is sufficient clearance for all but the largest emergency response vessels to fit under the bridge without the need to wait for a bridge opening. This would eliminate most of the delay to emergency response currently experienced due to the bridge.

4.7.4 Environment

The following section presents the potential for impacts to the natural environment from Alternative 3. Compared to the No Build Alternative, Alternative 3 has more potential to impact coastal, wetland, and natural resources due to the required in-water construction. The following sections provide a screening-level assessment, therefore additional and more in-depth analyses of resource impacts would be required, per the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA), as the designs for the bridge progress.

IMPACT TO COASTAL RESOURCES

Coastal Zone Impacts

The New Bedford-Fairhaven Bridge is located within the designated coastal zone of the Commonwealth of Massachusetts; therefore, this project may be subject to a federal consistency review to ensure that the proposed project would be consistent with the enforceable policies of the federally approved coastal management program of the Commonwealth.

The construction required to raise the elevation of the approach on Fish Island under Alternative 3 has the potential to affect Chapter 91 Tidelands located on the eastern side of the island. A Chapter 91 Waterways authorization from the Massachusetts Department of Environmental Protection (MassDEP) may be required for the construction of new bridge structure.

Within its policy documents, the Massachusetts Office of Coastal Zone Management (CZM) strongly encourages early coordination with the agency to determine the appropriate level of coastal review that would be required for projects. Coordination with CZM should be undertaken during any future NEPA and MEPA phases of the project.

Floodplains

The proposed bridge would be located within the 100-year floodplain. Alternative 3 would require limited in-water construction work as the new bridge would be constructed on piles instead of on piers. This has limited potential to affect the 100-year floodplain and flood levels within this area. Flooding and construction within the 100-year floodplain is under the jurisdiction of CZM. Therefore, coordination with CZM would be needed in future phases of the project to determine the extent of potential impacts to the 100-year floodplain and the applicability of coastal hazard policies to this project.

Hazardous and Contaminated Materials

New Bedford Harbor has been designated as a Superfund Site and is currently undergoing an extensive clean-up effort by the EPA. Alternative 3 would require limited in-water construction work as the new bridge would be constructed on piles instead of on piers. Because of this, Alternative 3 requires less disturbance to the harbor floor and significantly less soil and sediment disturbance than the vertical lift and bascule (standard) build alternatives. However, all of the build alternatives have greater impacts than the No Build Alternative due to the in-water soil/sediment disturbance that would be expected from the removal of the existing swing span center pier structure.

As any designs for the bridge progress, coordination would be undertaken with the EPA and the MassDEP to determine the amount of disturbance anticipated during construction, options for mitigation and minimization, and for the appropriate disposal of the contaminated sediments.

IMPACT TO WETLAND RESOURCES

A small area of rocky intertidal wetlands is located on the western shore of Pope's Island. Temporary disturbance resulting from the construction of Alternative 3 may potentially affect this wetland type. Additional field verification of this wetland type, as well as consultation with the USACE and MassDEP, would be needed in future phases of this project to determine the extent of this resource.

Potential impacts to water quality may occur from the disturbance and removal of contaminated sediments from New Bedford-Fairhaven Harbor during construction. Coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination.

Proper erosion and sedimentation controls, as well as stormwater pollution prevention best management practices (BMPs), would be implemented during the construction phase to prevent or avoid any potential impacts to the wetlands and aquatic species known to reside within them. Examples of BMPs include silt fencing, biotubes, and regulated construction entrances. Consultation with USACE and MassDEP regarding avoidance and minimization of potential impacts as well as permitting requirements should be undertaken during any future phases of this project.

As project development progresses, special consideration should be given to the location of construction staging areas on Pope's Island. Coastal bank bluff and sea cliff wetlands form the southern shores of Pope's Island and the placement of construction staging areas within or adjacent to these wetlands should be avoided.

IMPACT TO NATURAL RESOURCES

Alternative 3 would not result in any impacts to Areas of Critical Environmental Concern (ACEC), prime farmland soils, or aquifers. Alternative 3 has the potential for temporary impacts to water quality, shellfish and fish habitat, and priority habitats as a result of construction.

Water Quality

Alternative 3 requires less in-water construction work than the vertical lift and bascule (standard). However, the potential impacts to water quality would greater than the No Build Alternative due to the in-water soil/sediment disturbance that would be expected from the removal of the existing swing span center pier structure.

Coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination. Additionally, proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to water quality from construction activities.

Shellfish and Fish Habitat

Alternative 3 has the potential to result in temporary impacts to shellfish and fish habitats from the construction of the proposed bridge. Since New Bedford Harbor has been designed as a shellfish growing area, coordination may be needed with MassDEP to ensure that construction activities do not disrupt active shellfish spawning grounds. Proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to shellfish and fish habitats from construction activities.

Although the consumption of fish and shellfish caught in the New Bedford Inner Harbor is regulated by the Massachusetts Department of Public Health (MDPH), consultation with the National Oceanographic Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) should be undertaken during future phases of this project to determine the presence of Essential Fish Habitats (EFH) within New Bedford-Fairhaven Harbor.

Priority Habitats

Alternative 3 is not anticipated to impact priority plant or animal habitats. However, additional field verification and/or consultation with the U.S. Fish and Wildlife Service (USFWS) and MassDEP may be required in future phases of the project to verify the presence of state and federally listed plant and animal species and habitats.

IMPACTS TO AIR QUALITY AND GREENHOUSE GASES FROM IDLING VEHICLES

None of the long-term alternatives, including the No Build Alternative, would increase traffic volumes on the corridor as compared to the 2035 No Build Condition described in Chapter 2. The number of bridge openings would remain the same. Consequently, none of the long-build alternatives has the potential to worsen air quality compared to the 2035 No Build Condition. In future phases of the project, a formal air quality evaluation (microscale or mesoscale) would be required to determine the proposed project's impacts as compared to the National Ambient Air Quality Standards (NAAQS).

In Alternative 3, the addition of bicycle and pedestrian facilities along the Route 6 Corridor, including along a new movable span, may have the potential for localized air quality benefits.

The addition of these facilities has the potential to shift some motorists to non-motorized modes, potentially reducing the number of idling cars at bridge openings.

Potential temporary impacts to air quality would be anticipated from construction activities. BMPs would be implemented during construction to minimize vehicle emissions and manage fugitive dust. Typical air quality mitigation measures implemented during construction could include dust suppression and control methods to minimize fugitive dust on dry and windy days.

IMPACTS FROM NOISE

Since traffic volumes are not anticipated to increase substantially over existing levels, Alternative 3 is not anticipated to result in noise impacts to nearby noise-sensitive receptors. However, a formal noise assessment in compliance with the FHWA would be required in any future phases of this project.

Potential temporary noise impacts would result from construction activities and the operation of construction equipment. BMPs would be implemented during construction to mitigate potential noise impacts (particularly during non-daytime hours).

4.7.5 Land Use & Economic Development

NUMBER/VALUE OF BUSINESSES PERMANENTLY IMPACTED

The design of the Alternative 3 bridge utilizes primarily the same footprint as the existing swing span and will not require the acquisition of any additional property or ROW. Furthermore, the operation of the new moveable span will not vary dramatically in a way that would functionally affect the operation of area businesses and would not result in the reduction of the number of jobs. With absence of physical ROW changes and business operational impacts, no business or related property impacts or acquisition is anticipated due to physical or functional impacts.

SHIPPER COST SAVINGS

A variety of both landside and maritime benefits were considered to assess the economic benefits of the long-term build alternatives, including Alternative 3. While some may be quantified, others are more difficult to count and therefore the analysis considered both quantitative and qualitative benefits.

As a first step in the assessment, the potential benefits that could be generated by a new bridge were inventoried. In similar projects, automobile and truck benefits are often included, such as reduced travel time, vehicle operating cost savings, and emissions reduction, among others. On the marine side, moveable bridge improvements can affect shipper costs, travel time, and similar factors.

A thorough review of potential benefits indicated few differences between the 2035 No Build Condition and Alternative 3 in terms of quantifiable benefits. This is due to the relatively small variation between the proposed alternatives and the existing condition in most aspects of transportation. The lack of impact to existing and future traffic conditions results in no benefits from reduced travel time, vehicle operating cost savings, and emissions reduction. However, the change in horizontal clearance for vessels between the existing bridge and Alternative 3 is a significant change. The existing bridge provides a maximum horizontal clearance of 95 feet, while the horizontal clearance for Alternative 3 is 150 feet. Alternative 3 has no limitations on the vertical clearance of vessels.

This analysis only considers the benefits directly related to the bridge, an approach consistent with USDOT benefit-cost analysis guidance. While there is potential for additional economic development at the North Terminal and in the North Harbor, the chosen bridge alternative is only one component of that potential growth. As a result, it would be disingenuous to attribute that economic development potential *exclusively* to the new bridge. Additionally, when looking for the true differences between bridge alternatives, it is important to examine only the benefits associated directly with the bridge.

Landside Benefits

Traditional benefits associated with bridge improvements include both landside and maritime components. In the case of the proposed alternatives, no landside impacts were found. Each of the alternatives maintains the same bridge opening duration and creates no difference in general vehicular, bicycle, or pedestrian traffic operations. In other words, an automobile driver who uses the bridge today would discern no improvement in travel time, or achieve any other transportation related benefits, with a new bridge. Similarly, pedestrian and bicycle traffic would observe no change in their travel time.

It is important to note that the duration and methods for construction may cause various delay or diversion impacts during the construction period. However, no impact was quantified as the transportation analysis showed no discernable diversion patterns that could be analyzed. The construction phase impacts will include a limited road closure while the bridge is being installed along with lane closures for the duration of the construction. It is anticipated that during bridge closures, detours and notifications by area ITS systems will be provided to minimize impacts to drivers. While the impacts cannot easily be quantified, it should be noted that the longer closures will have a greater potential for detrimental impacts to local businesses and diversion costs for roadway users.

Since it was determined that the bridge improvement would have minimal or no impact on long-term landside traffic and pedestrian patterns, no landside benefits were quantified or included in the benefits analysis.

Maritime Benefits

A series of interviews were held with maritime users to determine how the current bridge affects their operations and to identify the ways in which a new bridge could positively affect them. As discussed in Chapter 2, wind and its impact on the navigability through the bridge opening is a critical issue facing maritime users. For this analysis, maritime benefits are primarily due to a reduction in shipper costs associated with delays within New Bedford Harbor. Changes in the use of tugs with Alternative 3 were also considered as a potential benefit. Discussions with maritime experts indicated the tugs used are “ship assist” tugs that primarily aid with alignment to the berth. Accordingly, they will still be required for all large cargo vessels that berth in the North Harbor regardless of the selected alternative and no change to tug costs will occur for larger vessels.

The greatest difference between the No Build Alternative, which retains the existing clearance, and the build alternatives is the horizontal navigational clearance. The No Build Alternative maintains the 95 feet of horizontal navigational clearance, which creates issues for the large vessels that enter the North Harbor. When there are high winds, these vessels cannot transit the bridge until the wind speeds are lower, as there is not enough clearance to pass safely through in high wind conditions.

With Alternative 3, the horizontal navigational width would be 150 feet. This width would remove the need for larger vessels to remain moored south of the bridge should high winds prevail. In the past year, three of the 12 vessels were delayed for one day during their trip to New Bedford due to the existing bridge constraint. It is understood that each day of delay costs the shipper $40,000. Under existing conditions, approximately 25 percent of vessels are delayed for a full day, costing shippers a total of $120,000 per year. With Alternative 3, no ships would experience delay, which results in an average savings of $120,000 per year in shipper costs. Assuming that users of the harbor factor into their overall decision-making the potential cost of delay, the widening of the horizontal clearance would reduce the general cost of using the harbor.

Historically, up to 30 vessels have called upon the port in a single year. This is considered a reasonable upper limit, based on interviews conducted with key maritime users. Assuming that the bridge improvement induces vessel calls to meet this historic high, benefits associated with a reduction in delay time would be generated. These new vessels, however, are not currently using the Port of New Bedford. Rather, they are a projection of potential. As a result, and consistent with economic consumer surplus theory, the benefit they receive would be half of the benefit to existing users.

The change from 12 to 30 trips represents a portion of all potential vessels that did not use the Port of New Bedford under the existing conditions, but that would be “attracted” to New Bedford because the risk of delay and associated costs are mitigated with the wider horizontal clearance. The benefits to these additional vessels are estimated using the “rule of one-half,” indicating the change in consumer surplus associated with the removal of the risk of delay. In a future year with 30 total vessels, this would result in a benefit of $20,000 per vessel for the 18 additional vessels, or a total of $360,000.

Summary of Benefits

Table 4.23 summarizes the average annual benefits associated with Alternative 3 as compared to the current conditions that would be maintained under the No Build Alternative. As discussed above, no landside benefits were identified or quantified. Additionally, there would be no change in the number of tugs that would be required, so the total costs would remain the same. The benefits generated by any of the new bridge alternatives is estimated to be $480,000 with delay costs representing $120,000 and savings to new cargo vessels $360,000.

Table 4.23. Average Single-Year Benefits of Bridge Replacement Alternatives

Benefit Category	Annual Savings (2015$)
Landside Transportation Savings	$0
Delay Cost Savings	$120,000
Savings to New Cargo Vessels	$360,000
Change in Tug Costs	$0
Total Benefits	$480,000

4.7.6 Community

The impacts to community resources, such as open space, recreational areas, or historic or cultural resources were also evaluated for Alternative 3. Additionally, access to businesses along the corridor and impacts to Environmental Justice (EJ) populations were evaluated. The study team also considered the visual impacts of a new bridge structure.

IMPACT TO PROTECTED AND RECREATIONAL OPEN SPACE

Alternative 3 would not result in any impacts to protected and/or recreational open space. An evaluation of publicly owned parklands, per Section 4(f) of the Department of Transportation Act of 1966, would be required for any future phases of this project.

As the project development phase continues and the designs for the bridge progresses, special consideration should be given to the location of construction staging areas. Marine Park on Pope's Island is owned and operated by the City of New Bedford and occupies the southern half of the island, but should not be used for construction staging.

IMPACT TO CULTURAL/HISTORIC/ARCHEOLOGICAL RESOURCES

Under Alternative 3, the middle bridge's swing span of the National Register-eligible New Bedford-Fairhaven Bridge would be replaced with a single-leaf rolling bascule. The loss of the center span would diminish the integrity of this historic property.

In addition to direct effects to the New Bedford-Fairhaven Bridge, there is the potential for indirect visual effects to historic properties that lie within the larger study area. A portion of the through truss of the existing swing span is visible as a component of the urban/industrial landscape from both the Schooner Ernestina, located on the New Bedford waterfront, and buildings that lie along the eastern edge of the New Bedford Historic District (see Figure 2.11). Both the Schooner Ernestina and the New Bedford Historic District are National Historic Landmarks. In the closed position, the truss and counter-weight would be approximately eight feet higher than the height of the existing truss, when measured from the water. They would also be somewhat similar in massing when viewed from the New Bedford Historic District and the Schooner Ernestina. When open, the bridge would rise 103 feet above the top of the existing truss and would appear as a prominent visual feature on the skyline. While the replacement of the swing truss with a single-leaf bascule span would alter the visual setting of these two historic properties, it is not anticipated that this would adversely affect these resources given both the distance between the properties and the bridge, and the visual complexity of the viewshed.

Regardless of which long-term alternative is selected, FHWA will need to initiate consultation with the MHC in accordance with Section 106 of the National Historic Preservation Act. Consultation should also be undertaken with the New Bedford and Fairhaven Historical Commissions. Through this consultation, additional historic properties that may be eligible for, but are not yet listed in, the National Register of Historic Places will be identified. The potential for effects to archeological resources will also be determined. FHWA, working together with the MHC, will seek ways to avoid, minimize, or mitigate adverse effects beyond the HAER documentation that has already been completed. In addition to consultation under Section 106, the preparation of a programmatic 4(f) evaluation, in compliance with the U.S. Department of Transportation Act of 1966, will be required.

IMPACT TO BUSINESS ACCESS

The parcels surrounding the approaches to the middle bridge include the following businesses:

- Bridge Shoppes shopping center;
- Captain Leroy's marina;
- Maritime Terminals facility;
- AGM Marine Contractors, Inc.; and
- Tucker Roy Marin Towing and Salvage.

Alternative 3 does not include any modifications to the bridge approaches and utilizes the existing footprint. The horizontal alignment of the road and access to abutting properties will remain the same.

IMPACT TO ENVIRONMENTAL JUSTICE POPULATIONS

The locations of Environmental Justice (EJ) populations were identified in Chapter 2. Some EJ populations reside in neighborhoods that abut or are adjacent to the New Bedford-Fairhaven Bridge. Residential clusters of EJ populations reside at the western edge of the local study area in New Bedford and EJ populations (low-income) also reside throughout the local study area within Fairhaven. Consequently, an evaluation of the potential for disproportionately high and adverse human health or environmental effects of the project alternatives on minority populations and low-income populations, per *Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, would be required in future phases of the project to comply with NEPA and MEPA.

Bicycle and pedestrian improvements in Alternative 3 have the potential to substantially improve the ability of EJ populations, who may not own or have access to automobiles, to get across the bridge to access employment or other key destinations. The greatest potential for impacts to EJ populations would occur during construction. Under Alternative 3, the construction phase would be approximately two years long. The bridge would be closed to vehicular, bicycle, and pedestrian traffic for three months. No transit service currently operates across the bridge.

Alternative 3 also has the potential to result in other temporary construction impacts to the EJ populations located in close proximity to the proposed bridge. Potential impacts could include noise, glare, fumes, and dust from construction equipment as well as changes in traffic patterns and access to businesses due to the movement of construction vehicles. Potential construction period impacts would be mitigated with BMPs for construction activities including those used to minimize dust, noise, maintenance, and protection of traffic plans, and limiting the hours of construction. Further analyses under NEPA and MEPA would be required to determine if construction-related impacts would be disproportionately higher on low-income and minority populations.

Alternative 3, along with all of the long-term build alternatives, has the same proportion of impacts to EJ populations compared to non-EJ populations.

VISUAL IMPACTS

The visual impacts from Alternative 3 would be limited. When the bridge is in the down position, it would look have a similar visual impact as the existing swing bridge as both are truss structures. The Alternative 3 bridge truss is the same height as the existing bridge (55 feet above the roadway surface), but since the roadway deck is elevated in this alternative, the top of the Alternative 3 truss is approximately 75 feet above MHW. The top of the existing truss is approximately 70 feet above MHW. When the bridge is in the up (or open) position, the bridge leaf would extend approximately 170 feet high above the roadway surface or 190 feet above the water line. This is approximately 100 feet above the top of the existing truss.

Although the bridge would be visible from a greater distance while in the up position, the topography and the significant development that surrounds the harbor would shield the view of all but the top of the bridge deck in the up position from most locations. Figure 4.6 and Figure 4.7 provides simulated renderings of what the bridge would look like if standing at Captain Leroy's on Pope's Island.

4.7.7 Alternative Feasibility

CAPITAL COST

The estimated cost for Alternative 3 is between $50 and $70 million. This capital cost would include the bridge design and permitting, removal and demolition of the existing swing bridge and construction of the new bridge. Limits of construction would be generally limited to the 289-foot length of the existing swing span with modifications to the approach spans limited to raising the approaches to provide the necessary under bridge clearances. It is estimated that this work would all be done utilizing the existing piers and newly reconstructed pier caps.

It is assumed that dredging and disturbance of the harbor sediments would be limited to construction of the tower structures and fendering system and removal of the existing swing span center pier structure. A more detailed cost estimate would be developed as additional information regarding subsurface conditions, bridge specifications, and design details are developed through the project development process.

OPERATING AND MAINTENANCE COSTS

Upon completion of construction, Alternative 3 will require both routine maintenance and daily operating costs. Table 4.24 provides the estimated annual costs required to operate and maintain the bridge, which are approximately $80,000 less than double-leaf alternatives that have high costs associated with electrical and lubrication costs to operate two mechanical units. Like the No Build Alternative, Alternative 3 requires just a single mechanical unit to operate the moveable span.

Table 4.24. Alternative 3 Annual Operating and Maintenance Costs

Operating Costs	Type	Annual Cost (2015$)
Operating Cost	Electricity utility	$ 50,000
Operating Cost	Stand by generator	$ 2,600
Operating Cost	Bridge operators	$300,000
Routine Maintenance	Monthly bridge lubrication	$ 14,400
Routine Maintenance	Replace lamps	$ 1,500
Routine Maintenance	Replace gate arms	$ 7,000
Routine Maintenance	Miscellaneous minor repairs	$ 12,000
Routine Maintenance	Guard rail repairs	$ 20,000
	TOTAL	$ 407,500

In addition to the annual operating and maintenance costs identified above, Alternative 3 would require major repairs to be conducted on a regular basis to maintain the bridge in a state of good repair and ensure its ongoing utility. The schedule of major repairs included in Table 4.25 is an estimate of repairs that is typical for rolling bascule bridges in similar environments. Over a 50-year span, it should be anticipated that approximately $9.5 million worth of repairs (in 2015 dollars) will be required.

Table 4.25. Alternative 3 Schedule of Major Repairs

Year	Work Performed	Cost (2015$)
10	Fender repairs	$ 250,000
15	Minor Structural repairs	$ 500,000
	Deck repairs	$ 250,000
25	Electrical control repairs	$ 500,000
	Minor Structural repairs	$ 750,000
	Fender repair	$ 250,000
	Control House repairs	$ 100,000
30	Deck repairs	$ 250,000
35	Replace traffic gates	$ 200,000
	Electrical system rehabilitation	$ 1,500,000
	Structural rehabilitation	$ 2,000,000
	Substructure repairs	$1,000,000
40	Fender repairs	$ 250,000
	Machinery rehabilitation	$1,500,000
45	Deck repairs	$ 250,000
	TOTAL	$9,550,000

CONSTRUCTION PHASE TRANSPORTATION IMPACTS

The construction phase of Alternative 3 would be a little over two years, or approximately 26-28 months. This alternative would allow two lanes of the roadway to remain open for most of the time to vehicular traffic. A full roadway shutdown would be required for approximately three months to allow to modification of the bridge approaches and to bring in the new bridge leaf. One of the two existing navigational channels would be open for most of the construction duration. However, one navigational closure would be required during a single long-weekend, which would occur in month 21 of construction. The new 150-foot-wide channel would then be open during the following month.

CONTRUCTION PHASE IMPACTS TO ABUTTING LAND OWNERS/BUSINESSES

The construction phase of each long-term alternative has the potential to impact area businesses due to the change in access during that period. During the two-year-long construction phase of Alternative 3, two vehicular lanes would remain open. Alternative 3 requires the roadway to be closed completely for a three-month period to allow for the removal of the existing swing span and the installation of the new rolling span. This road closure would likely result in some impacts to area businesses. Due to the longer construction duration and three-month roadway closure, the Alternative 3 impacts would be greater than the No Build Alternative, but would be less than some of the other build alternatives that require even longer roadway closures.

4.8 ALTERNATIVE 3W: WIDE DOUBLE-LEAF ROLLING BASCULE BRIDGE

This section provides an evaluation of Alternative 3W: Wide Double-leaf Rolling Bascule Bridge consistent with the evaluation criteria established at the initiation of the study. The evaluation criteria are specific measures of effectiveness used to assess benefits and impacts of each alternative.

During the review of impacts of the preliminary set of long-term alternatives, the study team developed Alternative 3W to address the potential navigational needs of changing uses in the North Harbor. Compared to Alternative 3 that has a single-leaf and provides 150 feet of navigational clearance, Alternative 3W is a wider double-leaf rolling bascule with a navigational width of 220 feet. Although Alternative 3 has only a single leaf, Figures 4.6 and 4.7 can be used for visual reference of Alternative 3W.

4.8.1 Bridge Operations

MINUTES PER BRIDGE CLOSURE

The opening sequence of the bridge in all of the long-term alternatives, including Alternative 3W, would continue to follow the AASHTO recommendation that requires approximately four minutes to open and an additional four minutes to close. The average time to open and close the bridge will continue to vary based on the marine traffic transit time and the time required to clear pedestrians and vehicles from the movable span before it can open to marine traffic. The minutes per bridge closure in Alternative 3W is the same as the current condition.

FEET OF VERTICAL CLEARANCE

The Alternative 3W bridge would be designed to have a vertical clearance of 14 feet above MHW when the bridge is in the closed position. The bridge would create no vertical clearance restrictions when the bridge is open to marine traffic.

FEET OF HORIZONTAL CLEARANCE (OPEN & CLOSED)

The Alternative 3W bridge would include approximately 220 feet of navigational clearance. The bridge would be aligned so that the eastern bridge abutment is in approximately the same location as the existing eastern abutment. The western abutment is located 220 feet to the west. The opening width is the maximum that could be established without affecting the bridge approach on Fish Island.

NUMBER OF DAILY BRIDGE OPENINGS

As described in the No Build Alternative, the bridge currently operates on a fixed schedule each day. For all of the long-term alternatives, including Alternative 3W, the schedule and number of daily bridge openings are expected to stay the same.

LONG-TERM RELIABILITY RISK

Since each moveable bridge includes a complex interaction of mechanical, electrical and structural components, there is an inherent risk in a moveable bridge that one of these systems will not operate as designed on any particular day and result in the inability for the bridge to open or close. Some moveable bridge types are at greater risk of inoperability than others due to the nature of their design and the conditions and environment that they operate within. As inoperability of a bridge for a period of time results in community and economic impacts, the risk associated with bridge reliability in the long-term was assessed. This included a general assessment of existing bridges of the type and size under consideration in conditions similar to that of New Bedford Harbor and their ability to remain reliable throughout the life span of the bridge. As noted, all moveable bridges are complex and have some long-term reliability risk. It was estimated that a rolling bascule bridge with the span width and length of the New Bedford-Fairhaven Bridge when operating in the marine costal environment of New Bedford Harbor would have a high level of risk. Roadway bridges of similar size and type have had structural and corrosion issues that have created reliability issues and have caused the bridges to be shut down periodically. It is likely that even with regular maintenance, corrosion issues would regularly affect the operability of such a long and wide structure.

4.8.2 Transportation Impacts & Mobility Analysis

The evaluation and assessment of mobility along the corridor between County Street in New Bedford and Adams Street in Fairhaven is an important component of this study. Like of the long-term alternatives, Alternative 3W will not change vehicular traffic along the corridor. Unlike the No Build Alternative, Alternative 3W will provide additional pedestrian and bicycle facilities.

CORRIDOR INTERSECTION LOS, V/C RATIO, QUEUE LENGTHS & ROADWAY TRAVEL TIME/DELAY

As noted in the No Build Alternative analysis, none of the long-term alternatives, including Alternative 3W, will change result in changes to vehicular traffic along the corridor as compared to the 2035 No Build Condition described in Chapter 2. Each of the long-term alternatives being considered will result in the same number of bridge openings and the bridge will, on average, be open for the same duration. Therefore, the mobility analysis described previously in Section 4.2.2 related to the No Build Alternative is consistent with the results of intersection LOS, volume to capacity ratio, queue lengths, and travel time and delay analysis for Alternative 3W.

BICYCLE & PEDESTRIAN MOBILITY/CONNECTIVITY

The width of the existing swing span allows for five-foot-wide sidewalks on both the north and south sides and the roadway shoulders less than two feet in width. The rest of the corridor has a slightly wider ROW, but it is still not wide enough to accommodate five-foot-wide bike lanes. Consequently, bicyclists and pedestrians both use the sidewalks along the bridge corridor segment.

Most pedestrian/bicycle use of the bridge occurs on the southern sidewalk since this sidewalk directly connects to the New Bedford downtown and waterfront. A new pedestrian ramp was completed in 2014 as part of a new roadway ramp from northbound Route 18 to eastbound Route 6. Between the New Bedford and Fairhaven shorelines, pedestrian and bicycle connectivity is difficult due to a lack of secure crossings, ramps, and gaps in the sidewalk network.

Because of these access challenges and safety concerns, pedestrian and bicyclist use of the bridge is currently limited. During the peak hour counts conducted for the study, only one pedestrian was observed to walk the entire length of the bridge between New Bedford and Fairhaven. During the warmer months, it is understood that pedestrian and bicycle use is more frequent and increases during non-peak auto hours.

Like all of the build alternatives, Alternative 3W allows for a wider bridge with a 64-foot-wide ROW. This bridge width allows for the construction of four 11-foot-wide vehicular travel lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. However, while Alternative 3W provides improved facilities compared to the No Build Alternative, the delay for bicyclists and pedestrians will not change as it is controlled by the frequency and duration of bridge openings, which will not change from the current condition.

4.8.3 Safety

Improving roadway, pedestrian, bicycle, and marine safety, reducing conflicts between transportation modes, and increasing emergency vehicle access are important considerations for evaluating the long-term alternatives. This section provides an overview of the key safety concerns that will be addressed by Alternative 3W.

CONFORMANCE WITH AASHTO AND MASSDOT STANDARDS

For a bridge and approach roadway to be safe for vehicular traffic, it must be geometrically adequate. This consideration takes into account the number of lanes, lane and shoulder widths, approach roadway widths, horizontal clearances to roadside obstacles, stopping sight distances, vertical clearances and more. The standards for these criteria are identified in the AASHTO *Policy on Geometric Design of Highways and Streets* and the MassDOT *Project Development and Design Guidebook* (2006). Alternative 3W will conform to these standards with no known variance required.

DELAY TO EMERGENCY VEHICLE ACCESS

Both New Bedford and Fairhaven provide fire and emergency services to their respective municipalities. In case of bridge closure, Pope's Island can receive service from Fairhaven via the east bridge. St. Luke's Hospital in New Bedford is the only facility in the two municipalities that provides emergency services. Bridge closures can affect Emergency Medical Services (EMS) access to the hospital from Fairhaven. Alternative 3W will not affect the level of access or potential for delay of emergency vehicles compared to the No Build Alternative.

IMPACT TO HIGH VOLUME BICYCLE AND PEDESTRIAN LOCATIONS

A sidewalk runs along the entire length of the north and south sides of the Route 6 Corridor between MacArthur Drive in New Bedford and Middle Street in Fairhaven. When the current roadway construction is completed in 2015, the roadway shoulders will be widened by reducing the vehicular travel lane width. In Alternative 3W, the new bridge cross section will include both widened roadway shoulders and sidewalks. However, even though Alternative 3W provides additional pedestrian and bicycle facilities, high pedestrian or bicycle volumes are not seen on the bridge and are not anticipated in the future. Alternative 3W will have no impact to high volume bicycle or pedestrian locations.

IMPACT TO SAFE NAVIGATION

Due to the existing navigational width of the channels at the existing bridge, safe vessel navigation through the bridge is a serious concern and a significant constraint to the North Harbor. Concerns for safe navigation have resulted in vessel limitations, which have resulted in delays and additional costs for commercial vessels.

Navigation through the bridges 94- and 95-foot-wide channels is the primary concern for large commercial vessels. These vessels generally employ harbor tugs for ship assist when maneuvering through the harbor and the bridge. Even with the tugs, limitations are still in place for transiting through the bridge. These include wind speed, visibility, and daylight.

- Wind speed is the primary concern that limits vessels ability to pass through the bridge. In all cases, if the wind exceeds 25 knots, no large vessel will transit the bridge. If the vessel is over 400 feet in length, this may be reduced to as little as 12 knots given the direction and based on the pilot's discretion.
- No vessel will transit through the bridge if the visibility is less than one nautical mile. Although large vessels don't enter the harbor though the hurricane barrier if visibility is limited, changes in visibility can occur rapidly in the harbor due to fog or heavy precipitation.
- Vessels greater than 500 feet in length or over 80 feet in width transit through the bridge and hurricane barrier in daylight only.

When transiting the current bridge, there is limited room for larger vessels to maneuver, especially north of the bridge between Fish Island and Pope's Island. Vessels approach slowly and then increase speed as they enter the bridge opening to ensure that they can exercise better control of the vessel through the passage. The limited maneuvering space on either side of the bridge is complicated by the fact that typically ships approach the bridge on an angle due to slow approach speeds. This angle further reduces any free space between the vessel and the bridge as the vessel is moving through. The swing span's central pivot point, associated piers, and fendering system are located approximately in the center of the federal deep-water channel. This makes the bridge, in the perspective of the pilots, the most vulnerable navigation safety area in the harbor.

When larger ships head northbound through the bridge, limited space is available for stopping or maneuvering once they pass the bridge. Generally, two tugs are employed; one at the bow and one at the stern, but only one can assist once the vessel is in the bridge opening due to the width of the channel. The forward tug goes through the bridge first and can come back alongside once the bow clears. Proceeding northbound, once the vessel passes through the bridge and enters the basin, it must slow and stop before being maneuvered into a berth.

Generally, vessels do not require tugs on transiting southbound. When departing southbound, the vessel leaves the berth and turns in the basin in a manner that allows it to line up with the west channel that is used most of the time. Once lined up, it transits the opening and maintains its alignment with the federal deep-water channel.

While the No Build Alternative does not provide any change from the existing condition, Alternative 3W will result in significant improvements to safe navigation through the bridge. The 220 feet of horizontal clearance would mitigate many of the safe navigation concerns, most notably the wind restriction, which has a significant impact on vessel delay. The wider clearance would allow for full tug assistance throughout the bridge transit and would also minimize the impact of the limited maneuverable space in the North Harbor, which will not change as a result of the project.

4.8.4 Environment

The following section presents the potential for impacts to the natural environment from Alternative 3W. Compared to the No Build Alternative, Alternative 3W has more potential to impact coastal, wetland, and natural resources due to the required in-water construction. The following sections provide a screening-level assessment, therefore additional and more in-depth analyses of resource impacts would be required, per the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA), as the designs for the bridge progress.

IMPACT TO COASTAL RESOURCES

Coastal Zone Impacts

The New Bedford-Fairhaven Bridge is located within the designated coastal zone of the Commonwealth of Massachusetts; therefore, this project may be subject to a federal consistency review to ensure that the proposed project would be consistent with the enforceable policies of the federally approved coastal management program of the Commonwealth.

The construction required to raise the elevation of the approach on Fish Island under Alternative 3W has the potential to affect Chapter 91 Tidelands located on the eastern side of the island. A Chapter 91 Waterways authorization from the Massachusetts Department of Environmental Protection (MassDEP) may be required for the construction of new bridge structure.

Within its policy documents, the Massachusetts Office of Coastal Zone Management (CZM) strongly encourages early coordination with the agency to determine the appropriate level of coastal review that would be required for projects. Coordination with CZM should be undertaken during any future NEPA and MEPA phases of the project.

Floodplains

The proposed bridge would be located within the 100-year floodplain. Alternative 3W would require limited in-water construction work as the new bridge would be constructed on piles instead of on piers. This has limited potential to affect the 100-year floodplain and flood levels within this area. Flooding and construction within the 100-year floodplain is under the jurisdiction of CZM. Therefore, coordination with CZM would be needed in future phases of the project to determine the extent of potential impacts to the 100-year floodplain and the applicability of coastal hazard policies to this project.

Hazardous and Contaminated Materials

New Bedford Harbor has been designated as a Superfund Site and is currently undergoing an extensive clean-up effort by the EPA. Alternative 3W would require limited in-water construction work as the new bridge would be constructed on piles instead of on piers. Because of this, Alternative 3W requires less disturbance to the harbor floor and significantly less soil and sediment disturbance than the vertical lift and bascule (standard) build alternatives. However, all of the build alternatives have greater impacts than the No Build Alternative due to the in-water soil/sediment disturbance that would be expected from the removal of the existing swing span center pier structure.

As any designs for the bridge progress, coordination would be undertaken with the EPA and the MassDEP to determine the amount of disturbance anticipated during construction, options for mitigation and minimization, and for the appropriate disposal of the contaminated sediments.

IMPACT TO WETLAND RESOURCES

A small area of rocky intertidal wetlands is located on the western shore of Pope's Island. Temporary disturbance resulting from the construction of Alternative 3W may potentially affect this wetland type. Additional field verification of this wetland type, as well as consultation with the USACE and MassDEP, would be needed in future phases of this project to determine the extent of this resource.

Potential impacts to water quality may occur from the disturbance and removal of contaminated sediments from New Bedford-Fairhaven Harbor during construction. Coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination.

Proper erosion and sedimentation controls, as well as stormwater pollution prevention best management practices (BMPs), would be implemented during the construction phase to prevent or avoid any potential impacts to the wetlands and aquatic species known to reside within them. Examples of BMPs include silt fencing, biotubes, and regulated construction entrances. Consultation with USACE and MassDEP regarding avoidance and minimization of potential impacts as well as permitting requirements should be undertaken during any future phases of this project.

As project development progresses, special consideration should be given to the location of construction staging areas on Pope's Island. Coastal bank bluff and sea cliff wetlands form the southern shores of Pope's Island and the placement of construction staging areas within or adjacent to these wetlands should be avoided.

IMPACT TO NATURAL RESOURCES

Alternative 3W would not result in any impacts to Areas of Critical Environmental Concern (ACEC), prime farmland soils, or aquifers. Alternative 3W has the potential for temporary impacts to water quality, shellfish and fish habitat, and priority habitats as a result of construction.

Water Quality

Alternative 3W requires less in-water construction work than the vertical lift and bascule (standard). However, the potential impacts to water quality would greater than the No Build Alternative due to the in-water soil/sediment disturbance that would be expected from the removal of the existing swing span center pier structure.

Coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination. Additionally, proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to water quality from construction activities.

Shellfish and Fish Habitat

Alternative 3W has the potential to result in temporary impacts to shellfish and fish habitats from the construction of the proposed bridge. Since New Bedford Harbor has been designed as a shellfish growing area, coordination may be needed with MassDEP to ensure that construction activities do not disrupt active shellfish spawning grounds. Proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to shellfish and fish habitats from construction activities.

Although the consumption of fish and shellfish caught in the New Bedford Inner Harbor is regulated by the Massachusetts Department of Public Health (MDPH), consultation with the National Oceanographic Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) should be undertaken during future phases of this project to determine the presence of Essential Fish Habitats (EFH) within New Bedford-Fairhaven Harbor.

Priority Habitats

Alternative 3W is not anticipated to impact priority plant or animal habitats. However, additional field verification and/or consultation with the U.S. Fish and Wildlife Service

(USFWS) and MassDEP may be required in future phases of the project to verify the presence of state and federally listed plant and animal species and habitats.

IMPACTS TO AIR QUALITY AND GREENHOUSE GASES FROM IDLING VEHICLES

None of the long-term alternatives, including the No Build Alternative, would increase traffic volumes on the corridor as compared to the 2035 No Build Condition described in Chapter 2. The number of bridge openings would remain the same. Consequently, none of the long-build alternatives has the potential to worsen air quality compared to the 2035 No Build Condition. In future phases of the project, a formal air quality evaluation (microscale or mesoscale) would be required to determine the proposed project's impacts as compared to the National Ambient Air Quality Standards (NAAQS).

In Alternative 3W, the addition of bicycle and pedestrian facilities along the Route 6 Corridor, including along a new movable span, may have the potential for localized air quality benefits. The addition of these facilities has the potential to shift some motorists to non-motorized modes, potentially reducing the number of idling cars at bridge openings.

Potential temporary impacts to air quality would be anticipated from construction activities. BMPs would be implemented during construction to minimize vehicle emissions and manage fugitive dust. Typical air quality mitigation measures implemented during construction could include dust suppression and control methods to minimize fugitive dust on dry and windy days.

IMPACTS FROM NOISE

Since traffic volumes are not anticipated to increase substantially over existing levels, Alternative 3W is not anticipated to result in noise impacts to nearby noise-sensitive receptors. However, a formal noise assessment in compliance with the FHWA would be required in any future phases of this project.

Potential temporary noise impacts would result from construction activities and the operation of construction equipment. BMPs would be implemented during construction to mitigate potential noise impacts (particularly during non-daytime hours).

4.8.5 Land Use & Economic Development

NUMBER/VALUE OF BUSINESSES PERMANENTLY IMPACTED

The design of the Alternative 3W bridge utilizes primarily the same footprint as the existing swing span and will not require the acquisition of any additional property or ROW. Furthermore, the operation of the new moveable span will not vary dramatically in a way that would functionally affect the operation of area businesses and would not result in the reduction of the number of jobs. With absence of physical ROW changes and business operational impacts, no business or related property impacts or acquisition is anticipated due to physical or functional impacts.

SHIPPER COST SAVINGS

A variety of both landside and maritime benefits were considered to assess the economic benefits of the long-term build alternatives, including Alternative 3W. While some may be quantified, others are more difficult to count and therefore the analysis considered both quantitative and qualitative benefits.

As a first step in the assessment, the potential benefits that could be generated by a new bridge were inventoried. In similar projects, automobile and truck benefits are often included, such as reduced travel time, vehicle operating cost savings, and emissions reduction, among others. On the marine side, moveable bridge improvements can affect shipper costs, travel time, and similar factors.

A thorough review of potential benefits indicated few differences between the 2035 No Build Condition and Alternative 3W in terms of quantifiable benefits. This is due to the relatively small variation between the proposed alternatives and the existing condition in most aspects of transportation. The lack of impact to existing and future traffic conditions results in no benefits from reduced travel time, vehicle operating cost savings, and emissions reduction. However, the change in horizontal clearance for vessels between the existing bridge and Alternative 3W is a significant change. The existing bridge provides a maximum horizontal clearance of 95 feet, while the horizontal clearance for Alternative 3W is 220 feet. Alternative 3W has no limitations on the vertical clearance of vessels.

This analysis only considers the benefits directly related to the bridge, an approach consistent with USDOT benefit-cost analysis guidance. While there is potential for additional economic development at the North Terminal and in the North Harbor, the chosen bridge alternative is only one component of that potential growth. As a result, it would be disingenuous to attribute that economic development potential *exclusively* to the new bridge. Additionally, when looking for the true differences between bridge alternatives, it is important to examine only the benefits associated directly with the bridge.

Landside Benefits

Traditional benefits associated with bridge improvements include both landside and maritime components. In the case of the proposed alternatives, no landside impacts were found. Each of the alternatives maintains the same bridge opening duration and creates no difference in general vehicular, bicycle, or pedestrian traffic operations. In other words, an automobile driver who uses the bridge today would discern no improvement in travel time, or achieve any other transportation related benefits, with a new bridge. Similarly, pedestrian and bicycle traffic would observe no change in their travel time.

It is important to note that the duration and methods for construction may cause various delay or diversion impacts during the construction period. However, no impact was quantified as the transportation analysis showed no discernable diversion patterns that could be analyzed. The construction phase impacts will include a limited road closure while the bridge is being installed along with lane closures for the duration of the construction. It is anticipated that during bridge closures, detours and notifications by area ITS systems will be provided to minimize impacts to drivers. While the impacts cannot easily be quantified, it should be noted that the longer closures will have a greater potential for detrimental impacts to local businesses and diversion costs for roadway users.

Since it was determined that the bridge improvement would have minimal or no impact on long-term landside traffic and pedestrian patterns, no landside benefits were quantified or included in the benefits analysis.

Maritime Benefits

A series of interviews were held with maritime users to determine how the current bridge affects their operations and to identify the ways in which a new bridge could positively affect them. As discussed in Chapter 2, wind and its impact on the navigability through the bridge opening is a critical issue facing maritime users. For this analysis, maritime benefits are primarily due to a reduction in shipper costs associated with delays within New Bedford Harbor. Changes in the use of tugs with Alternative 3W were also considered as a potential benefit. Discussions with maritime experts indicated the tugs used are "ship assist" tugs that primarily aid with alignment to the berth. Accordingly, they will still be required for all large cargo vessels that berth in the North Harbor regardless of the selected alternative and no change to tug costs will occur for larger vessels.

The greatest difference between the No Build Alternative, which retains the existing clearance, and the build alternatives is the horizontal navigational clearance. The No Build Alternative maintains the 95 feet of horizontal navigational clearance, which creates issues for the large vessels that enter the North Harbor. When there are high winds, these vessels cannot transit the bridge until the wind speeds are lower, as there is not enough clearance to pass safely through in high wind conditions.

With Alternative 3W, the horizontal navigational width would be 220 feet. This width would remove the need for larger vessels to remain moored south of the bridge should high winds prevail. In the past year, three of the 12 vessels were delayed for one day during their trip to New Bedford due to the existing bridge constraint. It is understood that each day of delay costs the shipper $40,000. Under existing conditions, approximately 25 percent of vessels are delayed for a full day, costing shippers a total of $120,000 per year. With Alternative 3W, no ships would experience delay, which results in an average savings of $120,000 per year in shipper costs. Assuming that users of the harbor factor into their overall decision-making the potential cost of delay, the widening of the horizontal clearance would reduce the general cost of using the harbor.

Historically, up to 30 vessels have called upon the port in a single year. This is considered a reasonable upper limit, based on interviews conducted with key maritime users. Assuming that the bridge improvement induces vessel calls to meet this historic high, benefits associated with a reduction in delay time would be generated. These new vessels, however, are not currently using the Port of New Bedford. Rather, they are a projection of potential. As a result, and consistent with economic consumer surplus theory, the benefit they receive would be half of the benefit to existing users.

The change from 12 to 30 trips represents a portion of all potential vessels that did not use the Port of New Bedford under the existing conditions, but that would be "attracted" to New Bedford because the risk of delay and associated costs are mitigated with the wider horizontal clearance. The benefits to these additional vessels are estimated using the "rule of one-half," indicating the change in consumer surplus associated with the removal of the risk of delay. In a future year with 30 total vessels, this would result in a benefit of $20,000 per vessel for the 18 additional vessels, or a total of $360,000.

Summary of Benefits

Table 4.26 summarizes the average annual benefits associated with Alternative 3W as compared to the current conditions that would be maintained under the No Build Alternative. As discussed above, no landside benefits were identified or quantified. Additionally, there would be no change in the number of tugs that would be required, so the total costs would remain the same. The benefits generated by any of the new bridge alternatives is estimated to be $480,000 with delay costs representing $120,000 and savings to new cargo vessels $360,000.

Table 4.26. Average Single-Year Benefits of Bridge Replacement Alternatives

Benefit Category	Annual Savings (2015$)
Landside Transportation Savings	$0
Delay Cost Savings	$120,000
Savings to New Cargo Vessels	$360,000
Change in Tug Costs	$0
Total Benefits	$480,000

4.8.6 Community

The impacts to community resources, such as open space, recreational areas, or historic or cultural resources were also evaluated for Alternative 3W. Additionally, access to businesses along the corridor and impacts to Environmental Justice (EJ) populations were evaluated. The study team also considered the visual impacts of a new bridge structure.

IMPACT TO PROTECTED AND RECREATIONAL OPEN SPACE

Alternative 3W would not result in any impacts to protected and/or recreational open space. An evaluation of publicly owned parklands, per Section 4(f) of the Department of Transportation Act of 1966, would be required for any future phases of this project.

As the project development phase continues and the designs for the bridge progresses, special consideration should be given to the location of construction staging areas. Marine Park on Pope's Island is owned and operated by the City of New Bedford and occupies the southern half of the island, but should not be used for construction staging.

IMPACT TO CULTURAL/HISTORIC/ARCHEOLOGICAL RESOURCES

Under Alternative 3W, the middle bridge's swing span of the National Register-eligible New Bedford-Fairhaven Bridge would be replaced with a double-leaf rolling bascule. The loss of the center span would diminish the integrity of this historic property.

In addition to direct effects to the New Bedford-Fairhaven Bridge, there is the potential for indirect visual effects to historic properties that lie within the larger study area. A portion of the through truss of the existing swing span is visible as a component of the urban/industrial landscape from both the Schooner Ernestina, located on the New Bedford waterfront, and buildings that lie along the eastern edge of the New Bedford Historic District (see Figure 2.11). Both the Schooner Ernestina and the New Bedford Historic District are National Historic Landmarks. In the closed position, the two truss structures and counterweights would be approximately eight feet higher than the height of the existing truss, when measured from the water. They would also be somewhat similar in massing when viewed from the New Bedford Historic District and the Schooner Ernestina. When open, the two movable spans would rise 103 feet above the top of the existing truss and would appear as a prominent visual feature on the skyline. While the replacement of the swing truss with a double-leaf bascule span would alter the visual setting of these two historic properties, it is not anticipated that this would adversely affect these resources given both the distance between the properties and the bridge, and the visual complexity of the viewshed.

Regardless of which long-term alternative is selected, FHWA will need to initiate consultation with the MHC in accordance with Section 106 of the National Historic Preservation Act. Consultation should also be undertaken with the New Bedford and Fairhaven Historical Commissions. Through this consultation, additional historic properties that may be eligible for, but are not yet listed in, the National Register of Historic Places will be identified. The potential for effects to archeological resources will also be determined. FHWA, working together with the MHC, will seek ways to avoid, minimize, or mitigate adverse effects beyond the HAER documentation that has already been completed. In addition to consultation under Section 106, the preparation of a programmatic 4(f) evaluation, in compliance with the U.S. Department of Transportation Act of 1966, will be required.

IMPACT TO BUSINESS ACCESS

The parcels surrounding the approaches to the middle bridge include the following businesses:

- Bridge Shoppes shopping center;
- Captain Leroy's marina;
- Maritime Terminals facility;
- AGM Marine Contractors, Inc.; and
- Tucker Roy Marin Towing and Salvage.

Alternative 3W does not include any modifications to the bridge approaches and utilizes the existing footprint. The horizontal alignment of the road and access to abutting properties will remain the same.

IMPACT TO ENVIRONMENTAL JUSTICE POPULATIONS

The locations of Environmental Justice (EJ) populations were identified in Chapter 2. Some EJ populations reside in neighborhoods that abut or are adjacent to the New Bedford-Fairhaven Bridge. Residential clusters of EJ populations reside at the western edge of the local study area in New Bedford and EJ populations (low-income) also reside throughout the local study area within Fairhaven. Consequently, an evaluation of the potential for disproportionately high and adverse human health or environmental effects of the project alternatives on minority populations and low-income populations, per *Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, would be required in future phases of the project to comply with NEPA and MEPA.

Bicycle and pedestrian improvements in Alternative 3W have the potential to substantially improve the ability of EJ populations, who may not own or have access to automobiles, to get across the bridge to access employment or other key destinations. The greatest potential for impacts to EJ populations would occur during construction. Under Alternative 3W, the construction phase would be approximately two years long. The bridge would be closed to vehicular, bicycle, and pedestrian traffic for three months. No transit service currently operates across the bridge.

Alternative 3W also has the potential to result in other temporary construction impacts to the EJ populations located in close proximity to the proposed bridge. Potential impacts could include noise, glare, fumes, and dust from construction equipment as well as changes in traffic patterns and access to businesses due to the movement of construction vehicles. Potential construction period impacts would be mitigated with BMPs for construction activities including those used to minimize dust, noise, maintenance, and protection of traffic plans, and limiting the hours of construction. Further analyses under NEPA and MEPA would be required to determine if construction-related impacts would be disproportionately higher on low-income and minority populations.

Alternative 3W, along with all of the long-term build alternatives, has the same proportion of impacts to EJ populations compared to non-EJ populations.

VISUAL IMPACTS

The visual impacts from Alternative 3W would be limited. When the bridge is in the down position, it would look have a similar visual impact as the existing swing bridge as both are truss structures. The Alternative 3W bridge trusses are the same height as the existing bridge (55 feet above the roadway surface), but since the roadway deck is elevated in this alternative, the top of the Alternative 3W truss is approximately 75 feet above MHW. The top of the existing truss is approximately 70 feet above MHW. When the bridge is in the up (or open) position, the bridge leaf would extend approximately 130 feet high above the roadway surface or 150 feet above the water line. This is approximately 60 feet above the top of the existing truss.

Although the bridge would be visible from a greater distance while in the up position, the topography and the significant development that surrounds the harbor would shield the view of all but the top of the bridge deck in the up position from most locations. Although Alternative 3 has a longer single-leaf, Figure 4.6 and Figure 4.7 provides simulated renderings of what a rolling bascule bridge would look like if standing at Captain Leroy's on Pope's Island.

4.8.7 Alternative Feasibility

CAPITAL COST

The estimated cost for Alternative 3W is between $90 and $110 million. This capital cost would include the bridge design and permitting, removal and demolition of the existing swing bridge and construction of the new bridge. Limits of construction would be generally limited to the 289-foot length of the existing swing span with modifications to the approach spans limited to raising the approaches to provide the necessary under bridge clearances. It is estimated that this work would all be done utilizing the existing piers and newly reconstructed pier caps.

It is assumed that dredging and disturbance of the harbor sediments would be limited to construction of the piers and fendering system and removal of the existing swing bridge center pier structure. A more detailed cost estimate would be developed as additional information regarding subsurface conditions, bridge specifications, and design details are developed through the project development process.

OPERATING AND MAINTENANCE COSTS

Upon completion of construction, Alternative 3W will require both routine maintenance and daily operating costs. Table 4.27 provides the estimated annual costs required to operate and maintain the bridge, which are the same as the other double-leaf alternatives that have two mechanical units to operate and maintain.

Table 4.27. Alternative 3W Annual Operating and Maintenance Costs

Operating Costs	Type	Annual Cost (2015$)
Operating Cost	Electricity utility	$ 100,000
Operating Cost	Stand by generator	$ 2,600
Operating Cost	Bridge operators	$300,000
Routine Maintenance	Monthly bridge lubrication	$ 27,600
Routine Maintenance	Replace lamps	$ 1,500
Routine Maintenance	Replace gate arms	$ 18,000
Routine Maintenance	Miscellaneous minor repairs	$ 20,000
Routine Maintenance	Guard rail repairs	$ 20,000
	TOTAL	$ 489,700

In addition to the annual operating and maintenance costs identified above, the Alternative 3W bridge will require major repairs to be conducted on a regular basis to maintain the bridge in a state of good repair and ensure its ongoing utility. The schedule of major repairs included in Table 4.28 is an estimate of repairs that is typical for rolling bascule bridges in similar environments. Over a 50-year span, it should be anticipated that approximately $12.1 million worth of repairs (in 2015 dollars) will be required.

Table 4.28. Alternative 3W Schedule of Major Repairs

Year	Work Performed	Cost (2015$)
10	Fender repairs	$ 250,000
15	Minor Structural repairs Deck repairs	$1,000,000 $ 250,000
25	Electrical control repairs Minor Structural repairs Fender repair Control House repairs	$ 700,000 $ 1,000,000 $ 250,000 $ 100,000
30	Deck repairs	$ 250,000
35	Replace traffic gates Electrical system rehabilitation Structural rehabilitation Substructure repairs	$ 300,000 $ 1,500,000 $ 2,000,000 $1,000,000
40	Fender repairs Machinery rehabilitation	$ 250,000 $3,000,000
45	Deck repairs	$ 250,000
	TOTAL	$12,100,000

CONSTRUCTION PHASE TRANSPORTATION IMPACTS

The construction phase of Alternative 3W would be a little over two years, or approximately 26-28 months. This alternative would allow two lanes of the roadway to remain open for most of the time to vehicular traffic. A full roadway shutdown would be required for approximately three months to allow to modification of the bridge approaches and to bring in the new bridge leaf. One of the two existing navigational channels would be open for most of the construction duration. However, one navigational closure would be required during a single long-weekend, which would occur in month 21 of construction. The new 220-foot-wide channel would then be open during the following month.

CONTRUCTION PHASE IMPACTS TO ABUTTING LAND OWNERS/BUSINESSES

The construction phase of each long-term alternative has the potential to impact area businesses due to the change in access during that period. During the two-year-long construction phase of Alternative 3W, two vehicular lanes would remain open. Alternative 3W requires the roadway to be closed completely for a three-month period to allow for the removal of the existing swing span and the installation of the new rolling span. This road closure would likely result in some impacts to area businesses. Due to the longer construction duration and three-month roadway closure, the Alternative 3W impacts would be greater than the No Build Alternative, but would be less than some of the other build alternatives that require even longer roadway closures.

4.9 ALTERNATIVE 3D: DOUBLE-LEAF DUTCH BASCULE BRIDGE

This section provides an evaluation of Alternative 3D: Double-leaf Dutch Bascule Bridge consistent with the evaluation criteria established at the initiation of the study. The evaluation criteria are specific measures of effectiveness used to assess benefits and impacts of each alternative.

During the review of impacts of the preliminary set of long-term alternatives, the study team developed Alternative 3D to explore the feasibility of a different bridge type than the rolling bascule bridge type. Alternative 3D provides 200 feet of navigational clearance and is a Dutch-style bascule bridge.

4.9.1 Bridge Operations

MINUTES PER BRIDGE CLOSURE

The opening sequence of the bridge in all of the long-term alternatives, including Alternative 3D, would continue to follow the AASHTO recommendation that requires approximately four minutes to open and an additional four minutes to close. The average time to open and close the bridge will continue to vary based on the marine traffic transit time and the time required to clear pedestrians and vehicles from the movable span before it can open to marine traffic. The minutes per bridge closure in Alternative 3D is the same as the current condition.

FEET OF VERTICAL CLEARANCE

The Alternative 3D bridge would be designed to have a vertical clearance of 14 feet above MHW when the bridge is in the closed position. The bridge would create no vertical clearance restrictions when the bridge is open to marine traffic.

FEET OF HORIZONTAL CLEARANCE (OPEN & CLOSED)

The Alternative 3D bridge would include approximately 200 feet of navigational clearance. The bridge would be aligned so that the eastern bridge abutment is in approximately the same location as the existing eastern abutment. The western abutment is located 200 feet to the west. The opening width is the maximum that could be established without affecting the bridge approach on Fish Island.

NUMBER OF DAILY BRIDGE OPENINGS

As described in the No Build Alternative, the bridge currently operates on a fixed schedule each day. For all of the long-term alternatives, including Alternative 3D, the schedule and number of daily bridge openings are expected to stay the same.

LONG-TERM RELIABILITY RISK

Since each moveable bridge includes a complex interaction of mechanical, electrical and structural components, there is an inherent risk in a moveable bridge that one of these systems will not operate as designed on any particular day and result in the inability for the bridge to open or close. Some moveable bridge types are at greater risk of inoperability than others due to the nature of their design and the conditions and environment that they operate within. As inoperability of a bridge for a period of time results in community and economic impacts, the risk associated with bridge reliability in the long-term was assessed. This included a general assessment of existing bridges of the type and size under consideration in conditions similar to that of New Bedford Harbor and their ability to remain reliable throughout the life span of the bridge. As noted, all moveable bridges are complex and have some long-term reliability risk. Since there have no double-leaf Dutch-style bascule bridges built with a similar length and width of the New Bedford-Fairhaven Bridge an assessment of the long-term reliability risk could not be completed. If this alternative proceeds into the preliminary design phase additional analysis will be required to assess the reliability of this bridge type in the costal marine environment with the length and widths identified taking into account the area wind loads while in the up position and the anticipated vehicle loads while in the down position.

4.9.2 Transportation Impacts & Mobility Analysis

The evaluation and assessment of mobility along the corridor between County Street in New Bedford and Adams Street in Fairhaven is an important component of this study. Like of the long-term alternatives, Alternative 3D will not change vehicular traffic along the corridor. Unlike the No Build Alternative, Alternative 3D will provide additional pedestrian and bicycle facilities.

CORRIDOR INTERSECTION LOS, V/C RATIO, QUEUE LENGTHS & ROADWAY TRAVEL TIME/DELAY

As noted in the No Build Alternative analysis, none of the long-term alternatives, including Alternative 3D, will change result in changes to vehicular traffic along the corridor as compared to the 2035 No Build Condition described in Chapter 2. Each of the long-term alternatives being considered will result in the same number of bridge openings and the bridge will, on average, be open for the same duration. Therefore, the mobility analysis described previously in Section 4.2.2 related to the No Build Alternative is consistent with the results of intersection LOS, volume to capacity ratio, queue lengths, and travel time and delay analysis for Alternative 3D.

BICYCLE & PEDESTRIAN MOBILITY/CONNECTIVITY

The width of the existing swing span allows for five-foot-wide sidewalks on both the north and south sides and the roadway shoulders less than two feet in width. The rest of the corridor has a slightly wider ROW, but it is still not wide enough to accommodate five-foot-wide bike lanes. Consequently, bicyclists and pedestrians both use the sidewalks along the bridge corridor segment.

Most pedestrian/bicycle use of the bridge occurs on the southern sidewalk since this sidewalk directly connects to the New Bedford downtown and waterfront. A new pedestrian ramp was completed in 2014 as part of a new roadway ramp from northbound Route 18 to eastbound Route 6. Between the New Bedford and Fairhaven shorelines, pedestrian and bicycle connectivity is difficult due to a lack of secure crossings, ramps, and gaps in the sidewalk network.

Because of these access challenges and safety concerns, pedestrian and bicyclist use of the bridge is currently limited. During the peak hour counts conducted for the study, only one pedestrian was observed to walk the entire length of the bridge between New Bedford and Fairhaven. During the warmer months, it is understood that pedestrian and bicycle use is more frequent and increases during non-peak auto hours.

Like all of the build alternatives, Alternative 3D allows for a wider bridge with a 64-foot-wide ROW. This bridge width allows for the construction of four 11-foot-wide vehicular travel lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. However, while Alternative 3D provides improved facilities compared to the No Build Alternative, the delay for bicyclists and pedestrians will not change as it is controlled by the frequency and duration of bridge openings, which will not change from the current condition.

4.9.3 Safety

Improving roadway, pedestrian, bicycle, and marine safety, reducing conflicts between transportation modes, and increasing emergency vehicle access are important considerations for evaluating the long-term alternatives. This section provides an overview of the key safety concerns that will be addressed by Alternative 3D.

CONFORMANCE WITH AASHTO AND MASSDOT STANDARDS

For a bridge and approach roadway to be safe for vehicular traffic, it must be geometrically adequate. This consideration takes into account the number of lanes, lane and shoulder widths, approach roadway widths, horizontal clearances to roadside obstacles, stopping sight distances, vertical clearances and more. The standards for these criteria are identified in the AASHTO *Policy on Geometric Design of Highways and Streets* and the MassDOT *Project Development and Design Guidebook* (2006). Alternative 3D will conform to these standards with no known variance required.

DELAY TO EMERGENCY VEHICLE ACCESS

Both New Bedford and Fairhaven provide fire and emergency services to their respective municipalities. In case of bridge closure, Pope's Island can receive service from Fairhaven via the east bridge. St. Luke's Hospital in New Bedford is the only facility in the two municipalities that provides emergency services. Bridge closures can affect Emergency Medical Services (EMS) access to the hospital from Fairhaven. Alternative 3D will not affect the level of access or potential for delay of emergency vehicles compared to the No Build Alternative.

IMPACT TO HIGH VOLUME BICYCLE AND PEDESTRIAN LOCATIONS

A sidewalk runs along the entire length of the north and south sides of the Route 6 Corridor between MacArthur Drive in New Bedford and Middle Street in Fairhaven. When the current roadway construction is completed in 2015, the roadway shoulders will be widened by reducing the vehicular travel lane width. In Alternative 3D, the new bridge cross section will include both widened roadway shoulders and sidewalks. However, even though Alternative 3D provides additional pedestrian and bicycle facilities, high pedestrian or bicycle volumes are not seen on the bridge and are not anticipated in the future. Alternative 3D will have no impact to high volume bicycle or pedestrian locations.

IMPACT TO SAFE NAVIGATION

Due to the existing navigational width of the channels at the existing bridge, safe vessel navigation through the bridge is a serious concern and a significant constraint to the North Harbor. Concerns for safe navigation have resulted in vessel limitations, which have resulted in delays and additional costs for commercial vessels.

Navigation through the bridges 94- and 95-foot-wide channels is the primary concern for large commercial vessels. These vessels generally employ harbor tugs for ship assist when maneuvering through the harbor and the bridge. Even with the tugs, limitations are still in place for transiting through the bridge. These include wind speed, visibility, and daylight.

- Wind speed is the primary concern that limits vessels ability to pass through the bridge. In all cases, if the wind exceeds 25 knots, no large vessel will transit the bridge. If the vessel is over 400 feet in length, this may be reduced to as little as 12 knots given the direction and based on the pilot's discretion.
- No vessel will transit through the bridge if the visibility is less than one nautical mile. Although large vessels don't enter the harbor though the hurricane barrier if visibility is limited, changes in visibility can occur rapidly in the harbor due to fog or heavy precipitation.
- Vessels greater than 500 feet in length or over 80 feet in width transit through the bridge and hurricane barrier in daylight only.

When transiting the current bridge, there is limited room for larger vessels to maneuver, especially north of the bridge between Fish Island and Pope's Island. Vessels approach slowly and then increase speed as they enter the bridge opening to ensure that they can exercise better control of the vessel through the passage. The limited maneuvering space on either side of the bridge is complicated by the fact that typically ships approach the bridge on an angle due to slow approach speeds. This angle further reduces any free space between the vessel and the bridge as the vessel is moving through. The swing span's central pivot point, associated piers, and fendering system are located approximately in the center of the federal deep-water channel. This makes the bridge, in the perspective of the pilots, the most vulnerable navigation safety area in the harbor.

When larger ships head northbound through the bridge, limited space is available for stopping or maneuvering once they pass the bridge. Generally, two tugs are employed; one at the bow and one at the stern, but only one can assist once the vessel is in the bridge opening due to the width of the channel. The forward tug goes through the bridge first and can come back alongside once the bow clears. Proceeding northbound, once the vessel passes through the bridge and enters the basin, it must slow and stop before being maneuvered into a berth.

Generally, vessels do not require tugs on transiting southbound. When departing southbound, the vessel leaves the berth and turns in the basin in a manner that allows it to line up with the west channel that is used most of the time. Once lined up, it transits the opening and maintains its alignment with the federal deep-water channel.

While the No Build Alternative does not provide any change from the existing condition, Alternative 3D will result in significant improvements to safe navigation through the bridge. The 200 feet of horizontal clearance would mitigate many of the safe navigation concerns, most notably the wind restriction, which has a significant impact on vessel delay. The wider clearance would allow for full tug assistance throughout the bridge transit and would also minimize the impact of the limited maneuverable space in the North Harbor, which will not change as a result of the project.

4.9.4 Environment

The following section presents the potential for impacts to the natural environment from Alternative 3D. Compared to the No Build Alternative, Alternative 3D has more potential to impact coastal, wetland, and natural resources due to the required in-water construction. The following sections provide a screening-level assessment, therefore additional and more in-depth analyses of resource impacts would be required, per the National Environmental Policy Act (NEPA) and the Massachusetts Environmental Policy Act (MEPA), as the designs for the bridge progress.

IMPACT TO COASTAL RESOURCES

Coastal Zone Impacts

The New Bedford-Fairhaven Bridge is located within the designated coastal zone of the Commonwealth of Massachusetts; therefore, this project may be subject to a federal consistency review to ensure that the proposed project would be consistent with the enforceable policies of the federally approved coastal management program of the Commonwealth.

The construction required to raise the elevation of the approach on Fish Island under Alternative 3D has the potential to affect Chapter 91 Tidelands located on the eastern side of the island. A Chapter 91 Waterways authorization from the Massachusetts Department of Environmental Protection (MassDEP) may be required for the construction of new bridge structure.

Within its policy documents, the Massachusetts Office of Coastal Zone Management (CZM) strongly encourages early coordination with the agency to determine the appropriate level of coastal review that would be required for projects. Coordination with CZM should be undertaken during any future NEPA and MEPA phases of the project.

Floodplains

The proposed bridge would be located within the 100-year floodplain. Alternative 3D would require limited in-water construction work as the new bridge would be constructed on piles instead of on piers. This has limited potential to affect the 100-year floodplain and flood levels within this area. Flooding and construction within the 100-year floodplain is under the jurisdiction of CZM. Therefore, coordination with CZM would be needed in future phases of the project to determine the extent of potential impacts to the 100-year floodplain and the applicability of coastal hazard policies to this project.

Hazardous and Contaminated Materials

New Bedford Harbor has been designated as a Superfund Site and is currently undergoing an extensive clean-up effort by the EPA. Alternative 3D would require limited in-water construction work as the new bridge would be constructed on piles instead of on piers. Because of this, Alternative 3D requires less disturbance to the harbor floor and significantly less soil and sediment disturbance than the vertical lift and bascule (standard) build alternatives. However, all of the build alternatives have greater impacts than the No Build Alternative due to the in-water soil/sediment disturbance that would be expected from the removal of the existing swing span center pier structure.

As any designs for the bridge progress, coordination would be undertaken with the EPA and the MassDEP to determine the amount of disturbance anticipated during construction, options for mitigation and minimization, and for the appropriate disposal of the contaminated sediments.

IMPACT TO WETLAND RESOURCES

A small area of rocky intertidal wetlands is located on the western shore of Pope's Island. Temporary disturbance resulting from the construction of Alternative 3D may potentially affect this wetland type. Additional field verification of this wetland type, as well as consultation with the USACE and MassDEP, would be needed in future phases of this project to determine the extent of this resource.

Potential impacts to water quality may occur from the disturbance and removal of contaminated sediments from New Bedford-Fairhaven Harbor during construction. Coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination.

Proper erosion and sedimentation controls, as well as stormwater pollution prevention best management practices (BMPs), would be implemented during the construction phase to prevent or avoid any potential impacts to the wetlands and aquatic species known to reside within them. Examples of BMPs include silt fencing, biotubes, and regulated construction entrances. Consultation with USACE and MassDEP regarding avoidance and minimization of potential impacts as well as permitting requirements should be undertaken during any future phases of this project.

As project development progresses, special consideration should be given to the location of construction staging areas on Pope's Island. Coastal bank bluff and sea cliff wetlands form the southern shores of Pope's Island and the placement of construction staging areas within or adjacent to these wetlands should be avoided.

IMPACT TO NATURAL RESOURCES

Alternative 3D would not result in any impacts to Areas of Critical Environmental Concern (ACEC), prime farmland soils, or aquifers. Alternative 3D has the potential for temporary impacts to water quality, shellfish and fish habitat, and priority habitats as a result of construction.

Water Quality

Alternative 3D requires less in-water construction work than the vertical lift and bascule (standard). However, the potential impacts to water quality would greater than the No Build Alternative due to the in-water soil/sediment disturbance that would be expected from the removal of the existing swing span center pier structure.

Coordination with the EPA and MassDEP would be undertaken in later phases of this project to determine the appropriate measures that would be required to minimize and/or mitigate potential impacts from contamination. Additionally, proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to water quality from construction activities.

Shellfish and Fish Habitat

Alternative 3D has the potential to result in temporary impacts to shellfish and fish habitats from the construction of the proposed bridge. Since New Bedford Harbor has been designed as a shellfish growing area, coordination may be needed with MassDEP to ensure that construction activities do not disrupt active shellfish spawning grounds. Proper erosion and sedimentation controls as well as stormwater pollution prevention BMPs would be implemented during the construction phase to prevent or minimize any additional potential impacts to shellfish and fish habitats from construction activities.

Although the consumption of fish and shellfish caught in the New Bedford Inner Harbor is regulated by the Massachusetts Department of Public Health (MDPH), consultation with the National Oceanographic Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) should be undertaken during future phases of this project to determine the presence of Essential Fish Habitats (EFH) within New Bedford-Fairhaven Harbor.

Priority Habitats

Alternative 3D is not anticipated to impact priority plant or animal habitats. However, additional field verification and/or consultation with the U.S. Fish and Wildlife Service

(USFWS) and MassDEP may be required in future phases of the project to verify the presence of state and federally listed plant and animal species and habitats.

IMPACTS TO AIR QUALITY AND GREENHOUSE GASES FROM IDLING VEHICLES

None of the long-term alternatives, including the No Build Alternative, would increase traffic volumes on the corridor as compared to the 2035 No Build Condition described in Chapter 2. The number of bridge openings would remain the same. Consequently, none of the long-build alternatives has the potential to worsen air quality compared to the 2035 No Build Condition. In future phases of the project, a formal air quality evaluation (microscale or mesoscale) would be required to determine the proposed project's impacts as compared to the National Ambient Air Quality Standards (NAAQS).

In Alternative 3D, the addition of bicycle and pedestrian facilities along the Route 6 Corridor, including along a new movable span, may have the potential for localized air quality benefits. The addition of these facilities has the potential to shift some motorists to non-motorized modes, potentially reducing the number of idling cars at bridge openings.

Potential temporary impacts to air quality would be anticipated from construction activities. BMPs would be implemented during construction to minimize vehicle emissions and manage fugitive dust. Typical air quality mitigation measures implemented during construction could include dust suppression and control methods to minimize fugitive dust on dry and windy days.

IMPACTS FROM NOISE

Since traffic volumes are not anticipated to increase substantially over existing levels, Alternative 3D is not anticipated to result in noise impacts to nearby noise-sensitive receptors. However, a formal noise assessment in compliance with the FHWA would be required in any future phases of this project.

Potential temporary noise impacts would result from construction activities and the operation of construction equipment. BMPs would be implemented during construction to mitigate potential noise impacts (particularly during non-daytime hours).

4.9.5 Land Use & Economic Development

NUMBER/VALUE OF BUSINESSES PERMANENTLY IMPACTED

The design of the Alternative 3D bridge utilizes primarily the same footprint as the existing swing span and will not require the acquisition of any additional property or ROW. Furthermore, the operation of the new moveable span will not vary dramatically in a way that would functionally affect the operation of area businesses and would not result in the reduction of the number of jobs. With absence of physical ROW changes and business operational impacts, no business or related property impacts or acquisition is anticipated due to physical or functional impacts.

SHIPPER COST SAVINGS

A variety of both landside and maritime benefits were considered to assess the economic benefits of the long-term build alternatives, including Alternative 3D. While some may be quantified, others are more difficult to count and therefore the analysis considered both quantitative and qualitative benefits.

As a first step in the assessment, the potential benefits that could be generated by a new bridge were inventoried. In similar projects, automobile and truck benefits are often included, such as reduced travel time, vehicle operating cost savings, and emissions reduction, among others. On the marine side, moveable bridge improvements can affect shipper costs, travel time, and similar factors.

A thorough review of potential benefits indicated few differences between the 2035 No Build Condition and Alternative 3D in terms of quantifiable benefits. This is due to the relatively small variation between the proposed alternatives and the existing condition in most aspects of transportation. The lack of impact to existing and future traffic conditions results in no benefits from reduced travel time, vehicle operating cost savings, and emissions reduction. However, the change in horizontal clearance for vessels between the existing bridge and Alternative 3D is a significant change. The existing bridge provides a maximum horizontal clearance of 95 feet, while the horizontal clearance for Alternative 3D is 200 feet. Alternative 3D has no limitations on the vertical clearance of vessels.

This analysis only considers the benefits directly related to the bridge, an approach consistent with USDOT benefit-cost analysis guidance. While there is potential for additional economic development at the North Terminal and in the North Harbor, the chosen bridge alternative is only one component of that potential growth. As a result, it would be disingenuous to attribute that economic development potential *exclusively* to the new bridge. Additionally, when looking for the true differences between bridge alternatives, it is important to examine only the benefits associated directly with the bridge.

Landside Benefits

Traditional benefits associated with bridge improvements include both landside and maritime components. In the case of the proposed alternatives, no landside impacts were found. Each of the alternatives maintains the same bridge opening duration and creates no difference in general vehicular, bicycle, or pedestrian traffic operations. In other words, an automobile driver who uses the bridge today would discern no improvement in travel time, or achieve any other transportation related benefits, with a new bridge. Similarly, pedestrian and bicycle traffic would observe no change in their travel time.

It is important to note that the duration and methods for construction may cause various delay or diversion impacts during the construction period. However, no impact was quantified as the transportation analysis showed no discernable diversion patterns that could be analyzed. The construction phase impacts will include a limited road closure while the bridge is being installed along with lane closures for the duration of the construction. It is anticipated that during bridge closures, detours and notifications by area ITS systems will be provided to minimize impacts to drivers. While the impacts cannot easily be quantified, it should be noted that the longer closures will have a greater potential for detrimental impacts to local businesses and diversion costs for roadway users.

Since it was determined that the bridge improvement would have minimal or no impact on long-term landside traffic and pedestrian patterns, no landside benefits were quantified or included in the benefits analysis.

Maritime Benefits

A series of interviews were held with maritime users to determine how the current bridge affects their operations and to identify the ways in which a new bridge could positively affect them. As discussed in Chapter 2, wind and its impact on the navigability through the bridge opening is a critical issue facing maritime users. For this analysis, maritime benefits are primarily due to a reduction in shipper costs associated with delays within New Bedford Harbor. Changes in the use of tugs with Alternative 3D were also considered as a potential benefit. Discussions with maritime experts indicated the tugs used are "ship assist" tugs that primarily aid with alignment to the berth. Accordingly, they will still be required for all large cargo vessels that berth in the North Harbor regardless of the selected alternative and no change to tug costs will occur for larger vessels.

The greatest difference between the No Build Alternative, which retains the existing clearance, and the build alternatives is the horizontal navigational clearance. The No Build Alternative maintains the 95 feet of horizontal navigational clearance, which creates issues for the large vessels that enter the North Harbor. When there are high winds, these vessels cannot transit the bridge until the wind speeds are lower, as there is not enough clearance to pass safely through in high wind conditions.

With Alternative 3D, the horizontal navigational width would be 200 feet. This width would remove the need for larger vessels to remain moored south of the bridge should high winds prevail. In the past year, three of the 12 vessels were delayed for one day during their trip to New Bedford due to the existing bridge constraint. It is understood that each day of delay costs the shipper $40,000. Under existing conditions, approximately 25 percent of vessels are delayed for a full day, costing shippers a total of $120,000 per year. With Alternative 3D, no ships would experience delay, which results in an average savings of $120,000 per year in shipper costs. Assuming that users of the harbor factor into their overall decision-making the potential cost of delay, the widening of the horizontal clearance would reduce the general cost of using the harbor.

Historically, up to 30 vessels have called upon the port in a single year. This is considered a reasonable upper limit, based on interviews conducted with key maritime users. Assuming that the bridge improvement induces vessel calls to meet this historic high, benefits associated with a reduction in delay time would be generated. These new vessels, however, are not currently using the Port of New Bedford. Rather, they are a projection of potential. As a result, and consistent with economic consumer surplus theory, the benefit they receive would be half of the benefit to existing users.

The change from 12 to 30 trips represents a portion of all potential vessels that did not use the Port of New Bedford under the existing conditions, but that would be "attracted" to New Bedford because the risk of delay and associated costs are mitigated with the wider horizontal clearance. The benefits to these additional vessels are estimated using the "rule of one-half," indicating the change in consumer surplus associated with the removal of the risk of delay. In a future year with 30 total vessels, this would result in a benefit of $20,000 per vessel for the 18 additional vessels, or a total of $360,000.

Summary of Benefits

Table 4.29 summarizes the average annual benefits associated with Alternative 3D as compared to the current conditions that would be maintained under the No Build Alternative. As discussed above, no landside benefits were identified or quantified. Additionally, there would be no change in the number of tugs that would be required, so the total costs would remain the same. The benefits generated by any of the new bridge alternatives is estimated to be $480,000 with delay costs representing $120,000 and savings to new cargo vessels $360,000.

Table 4.29. Average Single-Year Benefits of Bridge Replacement Alternatives

Benefit Category	Annual Savings (2015$)
Landside Transportation Savings	$0
Delay Cost Savings	$120,000
Savings to New Cargo Vessels	$360,000
Change in Tug Costs	$0
Total Benefits	$480,000

4.9.6 Community

The impacts to community resources, such as open space, recreational areas, or historic or cultural resources were also evaluated for Alternative 3D. Additionally, access to businesses along the corridor and impacts to Environmental Justice (EJ) populations were evaluated. The study team also considered the visual impacts of a new bridge structure.

IMPACT TO PROTECTED AND RECREATIONAL OPEN SPACE

Alternative 3D would not result in any impacts to protected and/or recreational open space. An evaluation of publicly owned parklands, per Section 4(f) of the Department of Transportation Act of 1966, would be required for any future phases of this project.

As the project development phase continues and the designs for the bridge progresses, special consideration should be given to the location of construction staging areas. Marine Park on Pope's Island is owned and operated by the City of New Bedford and occupies the southern half of the island, but should not be used for construction staging.

IMPACT TO CULTURAL/HISTORIC/ARCHEOLOGICAL RESOURCES

Under Alternative 3D, the middle bridge's swing span of the National Register-eligible New Bedford-Fairhaven Bridge would be replaced with a double-leaf Dutch-style bascule. The loss of the center span would diminish the integrity of this historic property.

In addition to direct effects to the New Bedford-Fairhaven Bridge, there is the potential for indirect visual effects to historic properties that lie within the larger study area. A portion of the through truss of the existing swing span is visible as a component of the urban/industrial landscape from both the Schooner Ernestina, located on the New Bedford waterfront, and buildings that lie along the eastern edge of the New Bedford Historic District (see Figure 2.11). Both the Schooner Ernestina and the New Bedford Historic District are National Historic Landmarks.

In the closed position, the beam and counterweights would be approximately the 55 feet above the roadway surface, approximately the same height as the existing truss. The massing of Alternative 3D would be reduced, with a tri-pod support structure on each end of the moveable span to support beams and the counterweight that are located above the roadway surface. They would also be somewhat similar in massing when viewed from the New Bedford Historic District and the Schooner Ernestina. When open, the two movable spans would rise 48 feet above the top of the existing truss and would appear as a prominent visual feature on the skyline. While the replacement of the swing truss with a double-leaf Dutch-style span would alter the visual setting of these two historic properties, it is not anticipated that this would adversely affect these resources given both the distance between the properties and the bridge, and the visual complexity of the viewshed.

Regardless of which long-term alternative is selected, FHWA will need to initiate consultation with the MHC in accordance with Section 106 of the National Historic Preservation Act. Consultation should also be undertaken with the New Bedford and Fairhaven Historical Commissions. Through this consultation, additional historic properties that may be eligible for, but are not yet listed in, the National Register of Historic Places will be identified. The potential for effects to archeological resources will also be determined. FHWA, working together with the MHC, will seek ways to avoid, minimize, or mitigate adverse effects beyond the HAER documentation that has already been completed. In addition to consultation under Section 106, the preparation of a programmatic 4(f) evaluation, in compliance with the U.S. Department of Transportation Act of 1966, will be required.

IMPACT TO BUSINESS ACCESS

The parcels surrounding the approaches to the middle bridge include the following businesses:

- Bridge Shoppes shopping center;
- Captain Leroy's marina;
- Maritime Terminals facility;
- AGM Marine Contractors, Inc.; and
- Tucker Roy Marin Towing and Salvage.

Alternative 3D does not include any modifications to the bridge approaches and utilizes the existing footprint. The horizontal alignment of the road and access to abutting properties will remain the same.

IMPACT TO ENVIRONMENTAL JUSTICE POPULATIONS

The locations of Environmental Justice (EJ) populations were identified in Chapter 2. Some EJ populations reside in neighborhoods that abut or are adjacent to the New Bedford-Fairhaven Bridge. Residential clusters of EJ populations reside at the western edge of the local study area in New Bedford and EJ populations (low-income) also reside throughout the local study area within Fairhaven. Consequently, an evaluation of the potential for disproportionately high and adverse human health or environmental effects of the project alternatives on minority populations and low-income populations, per *Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, would be required in future phases of the project to comply with NEPA and MEPA.

Bicycle and pedestrian improvements in Alternative 3D have the potential to substantially improve the ability of EJ populations, who may not own or have access to automobiles, to get across the bridge to access employment or other key destinations. The greatest potential for impacts to EJ populations would occur during construction. Under Alternative 3D, the construction phase would be approximately two years long. The bridge would be closed to vehicular, bicycle, and pedestrian traffic for three months. No transit service currently operates across the bridge.

Alternative 3D also has the potential to result in other temporary construction impacts to the EJ populations located in close proximity to the proposed bridge. Potential impacts could include noise, glare, fumes, and dust from construction equipment as well as changes in traffic patterns and access to businesses due to the movement of construction vehicles. Potential construction period impacts would be mitigated with BMPs for construction activities including those used to minimize dust, noise, maintenance, and protection of traffic plans, and limiting the hours of construction. Further analyses under NEPA and MEPA would be required to determine if construction-related impacts would be disproportionately higher on low-income and minority populations.

Alternative 3D, along with all of the long-term build alternatives, has the same proportion of impacts to EJ populations compared to non-EJ populations.

VISUAL IMPACTS

The visual impacts from Alternative 3D would be limited. When the bridge is in the down position, it would look have a similar visual impact as the existing swing bridge as both are approximately 55 feet above the roadway surface. The existing truss structure will be replaced with a beam and counterweight located above the roadway. The counterweight is typically a large concrete block, although it may be possible to include some aesthetic or iconic masking of the block. When the bridge is in the up (or open) position the two bridge leaves would extend approximately 118 feet high above the roadway surface or 138 feet above the water line. This is approximately 48 feet above the top of the existing truss. Although the bridge would be visible from a greater distance while in the up position, the topography and the significant development that surrounds the harbor would shield the view of all but the top of the bridge deck in the up position from most locations.

4.9.7 Alternative Feasibility

CAPITAL COST

The estimated cost for Alternative 3D is between $100 and $125 million. This capital cost would include the bridge design and permitting, removal and demolition of the existing swing bridge and construction of the new bridge. Limits of construction would be generally limited to the 289-foot length of the existing swing span with modifications to the approach spans limited to raising the approaches to provide the necessary under bridge clearances. It is estimated that this work would all be done utilizing the existing piers and newly reconstructed pier caps.

It is assumed that dredging and disturbance of the harbor sediments would be limited to construction of the piers and fendering system and removal of the existing swing bridge center pier structure. A more detailed cost estimate would be developed as additional information regarding subsurface conditions, bridge specifications, and design details are developed through the project development process.

OPERATING AND MAINTENANCE COSTS

Upon completion of construction, Alternative 3D will require both routine maintenance and daily operating costs. Table 4.30 provides the estimated annual costs required to operate and maintain the bridge, which are the same as the other double-leaf alternatives that have two mechanical units to operate and maintain.

Table 4.30. Alternative 3D Annual Operating and Maintenance Costs

Operating Costs	Type	Annual Cost (2015$)
Operating Cost	Electricity utility	$ 100,000
Operating Cost	Stand by generator	$ 2,600
Operating Cost	Bridge operators	$300,000
Routine Maintenance	Monthly bridge lubrication	$ 27,600
Routine Maintenance	Replace lamps	$ 1,500
Routine Maintenance	Replace gate arms	$ 18,000
Routine Maintenance	Miscellaneous minor repairs	$ 20,000
Routine Maintenance	Guard rail repairs	$ 20,000
	TOTAL	$ 489,700

In addition to the annual operating and maintenance costs identified above, the Alternative 3D bridge will require major repairs to be conducted on a regular basis to maintain the bridge in a state of good repair and ensure its on-going utility. The schedule of major repairs included in

Table 4.31 is an estimate of repairs that is typical for rolling bascule bridges in similar environments. Over a 50-year span, it should be anticipated that approximately $12.1 million worth of repairs (in 2015 dollars) will be required.

Table 4.31. Alternative 3D Schedule of Major Repairs

Year	Work Performed	Cost (2015$)
10	Fender repairs	$ 250,000
15	Minor Structural repairs Deck repairs	$1,000,000 $ 250,000
25	Electrical control repairs Minor Structural repairs Fender repair Control House repairs	$ 700,000 $ 1,000,000 $ 250,000 $ 100,000
30	Deck repairs	$ 250,000
35	Replace traffic gates Electrical system rehabilitation Structural rehabilitation Substructure repairs	$ 300,000 $ 1,500,000 $ 2,000,000 $1,000,000
40	Fender repairs Machinery rehabilitation	$ 250,000 $3,000,000
45	Deck repairs	$ 250,000
	TOTAL	$12,100,000

CONSTRUCTION PHASE TRANSPORTATION IMPACTS

The construction phase of Alternative 3D would be a little over two years, or approximately 26-28 months. This alternative would allow two lanes of the roadway to remain open for most of the time to vehicular traffic. A full roadway shutdown would be required for approximately three months to allow to modification of the bridge approaches and to bring in the new bridge leaf. One of the two existing navigational channels would be open for most of the construction duration. However, one navigational closure would be required during a single long-weekend, which would occur in month 21 of construction. The new 200-foot-wide channel would then be open during the following month.

CONTRUCTION PHASE IMPACTS TO ABUTTING LAND OWNERS/BUSINESSES

The construction phase of each long-term alternative has the potential to impact area businesses due to the change in access during that period. During the two-year-long construction phase of Alternative 3D, two vehicular lanes would remain open. Alternative 3D requires the roadway to be closed completely for a three-month period to allow for the removal of the existing swing span and the installation of the new rolling span. This road closure would likely result in some impacts to area businesses. Due to the longer construction duration and three-month roadway closure, the Alternative 3D impacts would be greater than the No Build Alternative, but would be less than some of the other build alternatives that require even longer roadway closures.

4.10 ANALYSIS OF SHORT/MEDIUM-TERM ALTERNATIVES

In addition to the long-term alternatives for the replacement of the New Bedford-Fairhaven Bridge, a number of short-term (less than five years) and medium-term (less than ten years) improvements have been considered and analyzed as part of the study. These improvements fall into three areas: intersection improvements, bicycle-pedestrian improvements and ITS/signage improvements. The following section identifies the potential improvements and discusses the potential impacts, the benefits, and the costs of each.

4.10.1 Intersection Improvements

Based on the findings of 2035 No Build Condition analysis described in Section 2.10, a detailed future conditions analysis was conducted to address the specific capacity issues and constraints that were identified. The goal of this analysis was to identify specific improvements that would optimize the traffic flow along the Route 6 Corridor. For the purpose of this analysis, the Route 6 Corridor includes the segment between Cottage Street in New Bedford and Adams Street in Fairhaven. The focus of the analysis was on the signalized intersections with approaches that currently operate at a mid LOS D or worse.

The following section provides a description of proposed improvements by intersection, an assessment of the resulting improvements to the intersection level of service, and a summary of overall travel time improvements by direction and by peak hour.

PROPOSED SHORT-TERM IMPROVEMENTS

The study team identified a number of signal-related intersection improvements that would not require significant capital costs or ROW acquisitions. As described in this section, signal-timing splits, phasing, coordination offsets, or cycle lengths changes are proposed for each of the nine corridor intersections. Since these changes are relatively quick to implement with minor costs and could provide immediate benefits to operations along the corridor, they are designated as short-term improvements. These improvements are expected to benefit the corridor if long-term closure of the bridge is required for construction.

Table 4.32 summarizes the proposed signal changes for each of the nine intersections along the Route 6 Corridor.

Table 4.32. Description of Proposed Signal Changes

Intersection	Peak Hour	Cycle Length	Timing Splits/Phasing	Coordination Offset
Kempton Street & Cottage Street	AM Peak	Increased from 80 sec to 90 sec	North/south decreased from 34 sec to 27 sec. Westbound increased from 30 sec to 47 sec.	No Change
Mill Street & Cottage Street	AM Peak	Increased from 80 sec to 90 sec	North/south decreased from 33 sec to 27 sec. Westbound increased from 34 sec to 50 sec.	Changed from 2 sec to 10 sec
Mill Street & County Street	PM Peak	Increased from 75 sec to 80 sec	North/south decreased by 3 seconds. Westbound increased from 25 sec to 33 sec.	Changed from 0 sec to 64 sec
Kempton Street & County Street	PM Peak	Increased from 75 sec to 80 sec	North/south increased from 38 sec to 43 sec.	No Change
Route 6 & Pleasant Street (Octopus Intersection)	AM Peak	Decreased from 155 sec to 120 sec	East and west split phase decreased from 30 sec and 35 sec, respectively to a concurrent NEMA phase of 57 sec. North and south split phases of 35 sec each, increased to concurrent NEMA phases of 48 sec and 36 sec, respectively. Northbound has a 12 sec lead-time.	No coordination
Route 6 at Pleasant Street (Octopus Intersection)	PM Peak	Decreased from 155 sec to 120 sec	East and west split phase decreased from 30 sec and 35 sec, respectively to a concurrent NEMA phase of 42 sec. North and south split phases of 35 sec each, increased to concurrent NEMA phases of 57 sec and 42 sec, respectively. Northbound has a 15 sec lead-time.	No coordination
Main Street & Huttleston Avenue	PM Peak	No Change	Eastbound decreased from 52 sec to 43 sec. Westbound decreased from 33 sec to 27 sec. North/south increased from 30 sec to 39 sec.	No Change
Middle Street & Huttleston Avenue	PM Peak	No Change	East/west decreased from 60 sec to 51 sec. Northbound increased from 30 sec to 39 sec.	No Change
Adams Street & Huttleston Avenue	AM Peak	No Change	Southbound lead decreased from 15 sec to 8 sec. North/south increased from 14 sec to 21 sec.	No Change

Note: NEMA stands for National Electrical Manufacturer's Association. NEMA Phasing is typical traffic signal phasing

Kempton Street and Cottage Street

During the AM peak hour, the southbound Cottage Street approach at Kempton Street will change from a LOS C under the 2014 Existing Condition to a LOS E under the 2035 No Build Condition. To improve this condition, an increase in cycle length and timing split modifications are proposed for this intersection. A change in cycle length, timings, and offset at the upstream intersection of Mill Street and Cottage Street will also help the LOS of this intersection. This improved coordination in the north/south direction will result in a better LOS C in the southbound direction in the 2035 Build Condition.

Mill Street and Cottage Street

During both AM and PM peak hours, all approaches at this intersection operate at mid LOS D or better during the 2035 No Build Condition. However, to achieve better traffic coordination in the north/south direction and improve southbound approach at the Kempton Street/Cottage Street intersection, cycle length, timings, and offset changes are proposed. As noted in Table 4.32, the cycle length will be lengthened, timing splits will be adjusted, and offsets will be modified. Due to the proposed improvements, the intersection would continue to operate at the same LOS (LOS B) as in the 2035No Build Condition, during both AM and PM peak hours. However, the average delay is two seconds shorter during the AM peak hour.

Mill Street and County Street

During the PM peak hour, the southbound County Street approach will change from a LOS D under the 2014 Existing Condition to a LOS F under the 2035 No Build Condition. To improve this condition, an increased cycle length, timing split changes, and offsets are proposed. A similar change in cycle length and timings is proposed at the downstream intersection of Kempton Street and County Street. This improves coordination in the north/south direction and thus provides a better LOS D in the southbound direction in the 2035 Build Condition.

Kempton Street and County Street

During both AM and PM peak hours, all approaches at this intersection operate at mid LOS D or better during the 2035 No Build Condition. However, to achieve better traffic coordination in the north/south direction and improve southbound condition at the Mill Street/County Street intersection described above, the cycle length, timings, and offset are proposed to be changed. As noted in Table 4.32, the cycle length will be increased and north/south timing splits will be increased. Due to the proposed improvements, the intersection would continue to operate at the same LOS (LOS B) as in the 2035 No Build Condition, during both AM and PM peak hours. However, the average delay is 1.5 seconds shorter during both peak hours.

Route 6 and Pleasant Street (“Octopus Intersection”)

During both AM and PM peak hours, all approaches at this intersection operate at a LOS E or worse and the overall intersection will operate at LOS F under the 2035 No Build Condition. This intersection currently operates with split signal phasing that allows traffic from each approach to go at the same time. An exclusive pedestrian phase is also available. This results in a high cycle length of 155 seconds, which causes inefficient operation and high delays.

The proposed signal timing will combine north and south traffic movements into one concurrent NEMA phase. The same would be true for east and west traffic movements. In addition, the exclusive pedestrian phase would be distributed among the concurrent phases to operate in conjunction with each non-opposing signal phase. This results in a reduced cycle length of 120 seconds, thus optimizing the operations at the intersection as well as reducing the delays on all approaches. The LOS and delays described in Tables 4.33 and 4.34 include these improvements.

As part of the *Pleasant Street-Kempton Street-Mill Street-Sixth Street-Route 6 Intersection Study* (December 2012, the Southeastern Regional Planning and Economic Development District (SRPEDD) recommended a concurrent pedestrian and traffic phasing for this intersection, which supports the choice of pedestrian phasing recommended in this study.

Additionally, SRPEDD looked at closing the Route 18 southbound off-ramp to westbound Route 6 as a second alternative and replacing the "Octopus Intersection" with a roundabout as a third alternative to improve this intersection. For the reasons described below, the alternative with closure of the Route 18 southbound off-ramp was deemed expensive and inappropriate for the minimal benefits achieved. The roundabout was ruled out due to lack of enough ROW.

The closure of the Route 18 southbound off-ramp was tested with the split traffic signal phasing that currently exists. With the exclusive pedestrian phase combined into the phasing, timing adjustments did not achieve a significant benefit.

However, it is expected that the Route 18 off-ramp closure combined with the concurrent NEMA traffic phasing and reduced cycle length (recommended in this study) would further reduce delays and improve safety. However, this option was not tested as part of the current study and would need further investigation.

Main Street and Huttleston Avenue

During the PM peak hour, the northbound approach of this intersection would change from a LOS D under the 2014 Existing Condition to a LOS E under the 2035 No Build Condition. The southbound approach would change from a low LOS E under the 2014 Existing Condition to a high LOS E under the 2035 No Build Condition. To improve this condition, the signal timing changes listed in Table 4.32 are proposed for each approach. This will provide a LOS D in both northbound and southbound directions in the 2035 Build Condition.

Middle Street and Huttleston Avenue

During both AM and PM peak hours, all approaches at this intersection would operate at LOS C or better during the 2035 No Build Condition. However, since this intersection is combined in signal operation with the intersection of Main Street and Huttleston Avenue, signal-timing changes are proposed during PM peak hour. The change in operations at this intersection due to the proposed timing changes will be negligible.

Adams Street and Huttleston Avenue

During the AM peak hour, the northbound approach would change from a LOS C under the 2014 Existing Condition to a LOS F under the 2035 No Build Condition. To improve this condition, the signal timing changes are proposed for two approaches at this intersection. This will provide a mid LOS D in the 2035 Build Condition.

CAPACITY ANALYSIS

A capacity analysis with the proposed improvements described above was conducted using Synchro software. An HCM-based methodology was applied to determine the improved future performance metrics such as volume-to-capacity ratio, delay, and LOS. A comparison of performance metrics for the 2035 No Build Condition and 2035 Build Condition is provided in Table 4.33. A detailed table showing improvements on individual approaches at corridor intersections is provided in Appendix F.

Table 4.33. Intersection Delay and LOS Summary, 2035 No Build vs 2035 Build Conditions

ID #	Intersection Name	2035 No Build Condition AM Int. Delay	2035 No Build Condition AM Int. LOS	2035 No Build Condition PM Int. Delay	2035 No Build Condition PM Int. LOS	2035 Build Condition AM Int. Delay	2035 Build Condition AM Int. LOS	2035 Build Condition PM Int. Delay	2035 Build Condition PM Int. LOS
1	Mill Street & Cottage Street	19.2	B	17.0	B	17.9	B	-	-
2	Kempton Street & Cottage Street	34.7	C	14.0	B	27.9	C	-	-
3	Mill Street & County Street	22.6	C	49.6	D	-	-	29.0	C
4	Kempton St & County St	17.5	B	17.5	B	-	-	16.0	B
5	Kempton St/Mill St & Purchase St	87.7	F	112.5	F	32.8	C	40.5	D
6	Huttleston Avenue & Middle Street	9.8	A	11.6	B	-	-	11.6	B
7	Huttleston Avenue & Main Street	26.3	C	28.6	C	-	-	27.3	C
8	Huttleston Avenue & Adams Street	39.1	D	18.1	B	34.0	D	-	-

TRAVEL TIME IMPROVEMENT

To better assess the conditions along the Corridor with the proposed improvements, the travel time along the corridor between Cottage Street and Adams Street was derived using the capacity analysis for the 2035 No Build Condition and 2035 Build Condition. These travel times are compared with the travel times experienced during the 2014 Existing Condition data collection. A comparison of the 2035 No Build Condition and 2035 Build Condition travel times is provided in Table 4.34.

Table 4.34. Route 6 Corridor Travel Time Between Cottage Street and Adams Street

Direction	2035 No Build AM Peak Hour (min.)	2035 No Build PM Peak Hour (min.)	2035 Build AM Peak Hour (min.)	2035 Build PM Peak Hour (min.)	AM Peak Hour (% change)	PM Peak Hour (% change)
Eastbound	7.2	6.5	6.6	5.9	9%	10%
Westbound	8.9	7.5	6.9	6.3	23%	16%

As noted in the above table, the travel times in the 2035 Build Condition are approximately ten percent better in the eastbound direction compared to the 2035 No Build Conditions. Similarly, travel timesavings in the westbound direction are 23 percent and 16 percent during AM and PM peak hours, respectively. The travel times are anticipated to be better than what is being experienced during the 2014 Existing Condition.

Since these improvements are all limited to signal timing changes, it is anticipated that the cost would be limited to the labor costs to make the changes. Depending upon the procedures used to make the changes, costs for traffic-related improvements would be less than $20,000.

4.10.2 Bicycle/Pedestrian Improvements

Based on the assessment of bicycle and pedestrian conditions along the corridor, three potential improvements have been identified. As shown in Figure 4.8, these improvements include:

- A bicycle and pedestrian path along Route 6 from Pleasant Street to Route 18;
- A pedestrian ramp and staircase to replace staircase on north side of bridge; and
- Completion of sidewalk network along MacArthur Drive, which is the primary pedestrian route from the bridge to the proposed Whale's Tooth Commuter Rail Station.

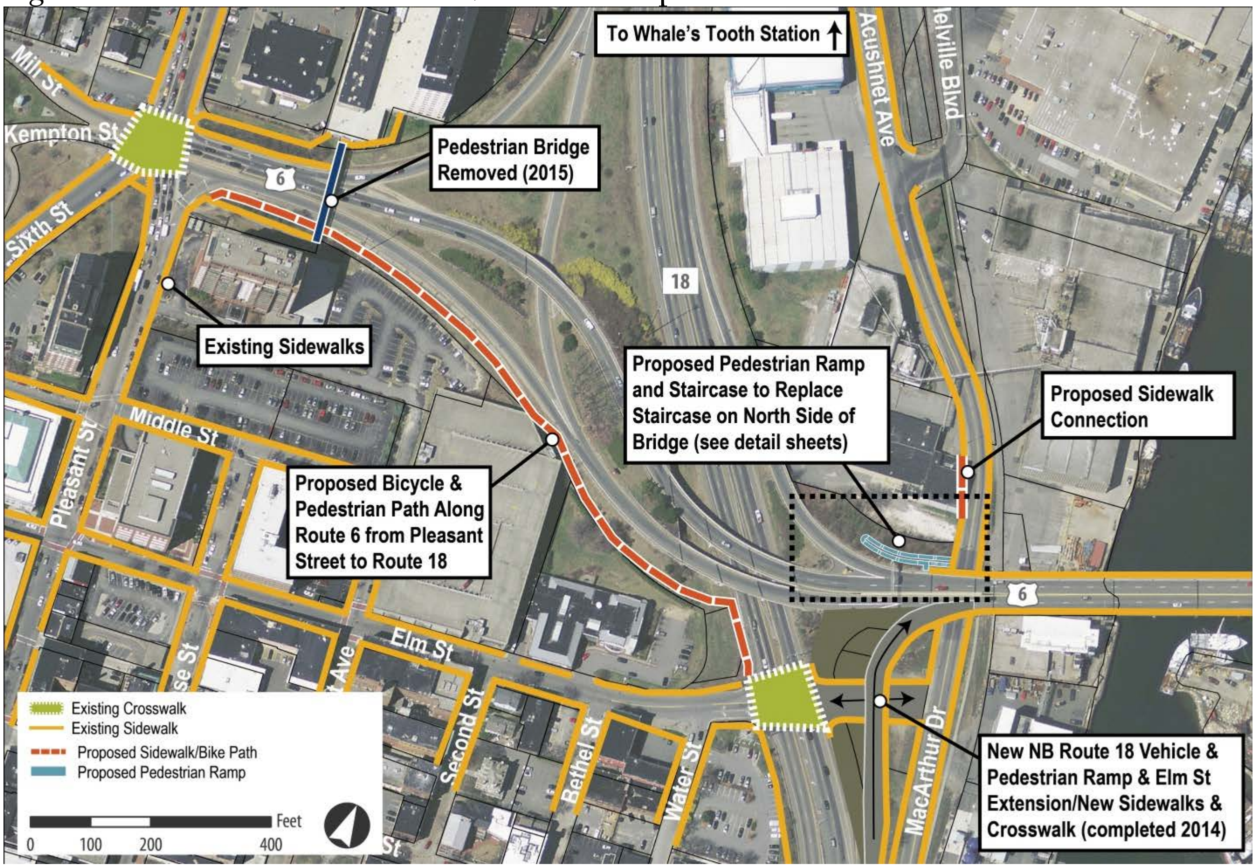
The following is an assessment of costs and impacts for each bicycle or pedestrian improvement.

PROPOSED BICYCLE AND PEDESTRIAN PATH FROM PLEASANT STREET TO ROUTE 18

A pedestrian path that provides a more direct path for pedestrians between the "Octopus Intersection" and the Route 18/Elm Street intersection is proposed for the corridor. The 10- to 12-foot-wide path would be located within on the south side of the existing Route 6 ROW. A four- to six-foot high fence would be installed to provide separation between the eastbound Route 6 travel lanes and ramp and the path.

As described in Chapter 2, the "Octopus Intersection" experiences the highest pedestrian activity along the corridor. During the evening peak hour, 59 pedestrians were counted at Kempton Street/Mill Street and Purchase Street intersection. Providing improved connections between this high pedestrian location and other pedestrian destinations, such as Marine Park on Pope's Island, the future Whale's Tooth Station, and the New Bedford waterfront will improve the pedestrian environment of the area.

Figure 4.8. Route 6 Corridor Bike/Pedestrian Improvements



To connect between these two points, pedestrians have to travel south on Pleasant Street and then east on Elm Street. This route will shorten the walk (or ride) between the two end points by about 400 feet from the current 1,600-foot walk. This would shorten the walk by about 25 percent or two minutes. Although the time and distance savings are not significant, the new route would be much safer as it would avoid the many intersections and driveways along the present route and provide a continuous sidewalk/pathway instead of the existing route along Elm Street, Acushnet Avenue and Pleasant Street. Most notably, pedestrians would avoid crossing the entrances to the Elm Street Garage and the parking lot to the Regency Apartments, which are types of driveways that are particularly unfriendly for pedestrians. The estimated cost for this 0.25-mile long multi-use path is $350,000. To ensure that safety is maintained along the corridor, design of the path will require the appropriate roadway separation, fencing, and lighting. Aside from ensuring that safety is maintained, there are no adverse impacts anticipated from construction of the path.

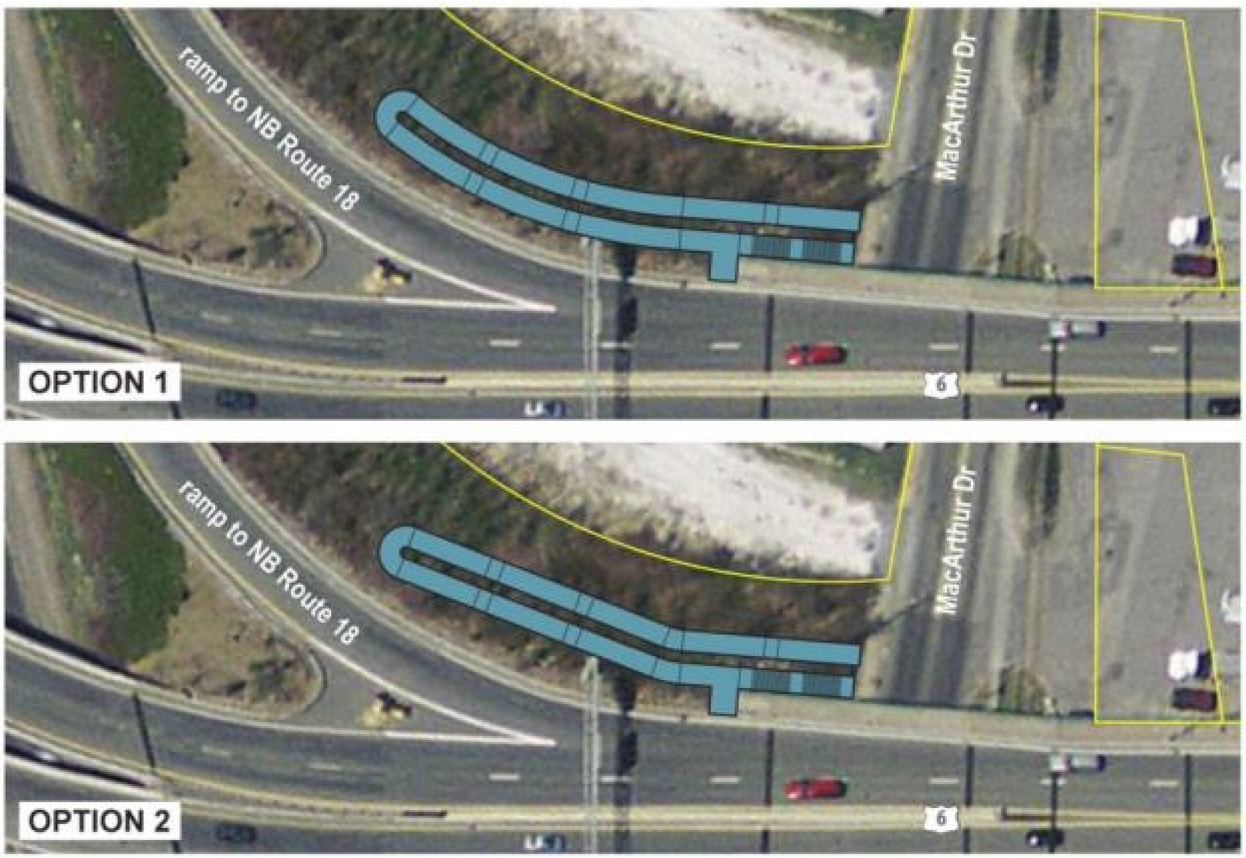
PROPOSED PEDESTRIAN RAMP TO REPLACE STAIRCASE ON NORTH SIDE OF BRIDGE

Upon completion of the ongoing highway work on both Route 6 and Route 18, many of the pedestrian and bicycle facilities will be enhanced and improved. However, the stairs connecting the north side of Route 6 to MacArthur Boulevard are only receiving minor improvements. Reconstructing this connection so that an ADA-compliant ramp system is provided will greatly enhance connectivity in the corridor. This will be especially important upon the completion of the Whale's Tooth Station located further north on Acushnet Avenue, which will be a significant new pedestrian and bicyclist destination in the area.

Due to the significant slope along the edge of the Route 6 ramp, the ramp will require the construction of retaining structures and fencing to ensure stability and safety. The estimated cost for this ramp structure is $450,000. Due to the location of the proposed ramp structure, there are no negative impacts anticipated resulting from construction.

Two different options for the ADA-compliant bicycle/pedestrian ramp are shown in Figure 4.9.

Figure 4.9. Potential Bike/Pedestrian Ramp Options



REPLACEMENT OF SIDEWALK CONNECTION ALONG MACARTHUR DRIVE

As shown in Figure 4.8, a segment of sidewalk is missing along MacArthur Drive just north of Route 6. Limited room exists along MacArthur Drive between the roadway curb line and the adjacent building, located at 255 MacArthur Drive. Currently, there is a beaten path along this segment where pedestrians travel along the grassy area. It is anticipated that with the opening of Whale's Tooth Station, pedestrian activity between the station and downtown New Bedford will increase along MacArthur Drive. It is proposed that a sidewalk be constructed in this important 85-foot long segment to fill the gap in the existing network. By adding this one sidewalk segment, the local pedestrian network will be more complete. The additional sidewalk connection will complement the recent and ongoing improvements to pedestrian facilities that have been made in the area.

Although the estimated construction cost of the sidewalk is limited to $15,000, it is anticipated that funding will be needed for the required additional property rights required for its construction. The pedestrian safety and accessibility benefits of providing this 85 feet of sidewalk are significant for this heavily traveled industrial truck route, with the benefits likely increasing over time with the construction of Whale's Tooth Station.

4.10.3 ITS/Signage Improvements

As previously described, each bridge opening results in vehicular delays between 12.5 to 22.5 minutes. Even though hourly bridge openings are regularly scheduled throughout the day, it has been noted throughout the study that travelers are sometimes unknowingly delayed due to lack of a bridge opening notification. The existing signage, although helpful, does not provide sufficient information regarding the status of a bridge opening to allow for appropriate route selection for many travelers.

Additional signs at locations where travelers can make appropriate detour route selections would benefit travelers. The existing ITS/signage system would result in increased benefits by implementing the following:

- Complete replacement of the existing ITS/sign system associated with the bridge;
- Upgrade of the ITS/sign system to provide additional information regarding travel time to the bridge and bridge status;
- Addition of two signs at the Route 6 and Route 240 intersection to facilitate route diversions along Route 240;
- Addition of a sign on I-195 Westbound to replace signs that were previously removed;
- Addition of a sign on Route 6 at the Adams Street intersection to facilitate route diversions along Adams Street; and
- Addition of a sign that is visible to Middle Street motorists to inform them of bridge closings.

The location of the existing ITS signs and the proposed ITS signs are shown in Figure 4.10.

Figure 4.10. Existing and Proposed ITS Signage Locations

COMPLETE REPLACEMENT OF EXISTING SYSTEM

Complete replacement of the existing ITS/signage system associated with the bridge would benefit travelers by providing a more reliable system. As previously noted the existing system was built with technology that is now outdated and difficult to repair or replace. Replacing the existing system would allow for installation of a variable message system that could be triggered by the bridge operator. Due to the urban context of most of the existing signs, the signs should be limited in size and provide helpful but short messages. These could be similar to the sign shown in Figure 4.11. Design considerations would include the size and location of the sign and the anticipated messages to be included.

Figure 4.11. Roadside ITS/Changeable Signage

To keep the signs small and fit within the context of the area but still provide the necessary information, the signs could be limited to two or three lines and provide information such as:

Next Bridge Closing
Scheduled at 2:15 pm

Bridge Closing
in 5 minutes

Bridge Now Closed
Seek Alt. Route

Bridge Opening
In 5 minutes

This information would benefit area travelers by providing additional information regarding the status of the bridge. The system information would be schedule-based or provided (through a semi-automated system) from the bridge operator. The estimated cost for this type of system is estimated be approximately $750,000 to $1,000,000 and would depend upon the specific sign type and the design for the associated communications system.

EXPAND THE ITS/SIGN SYSTEM

In addition to the signs currently in place, the system could be expanded to provide additional information to travelers at locations where they could make diversion decisions. These system expansion locations are all located in Fairhaven and are shown in Figure 4.10. These additional sign locations would provide information to approaches that currently don't have a bridge warning until the point where it is difficult to make an alternative route selection, or at locations where alternative route selection would be preferred. In locations where the existing changeable message signs are located, during peak hours it was measured that 60 percent of vehicles used a route that did not include the bridge when the signs were indicating the bridge was closed to traffic. At the Huttleston Avenue/Main Street intersection, this range resulted in a 30- to 50-car difference in peak hours. This indicates that travelers are utilizing the information to make route choices. If the system were expanded, the impact of the bridge openings may be reduced through better information regarding travel route options. The estimated cost for the expansion of the system is $400,000.

UPGRADE OF THE ITS/SIGN SYSTEM

The system could be upgraded to include the implementation of the MassDOT "GO Time" System or a similar functionality. In 2012, MassDOT initiated an operational test of a Bluetooth-based real time traveler information system. The system calculates travel time between two or more points along the roadway by using time stamps collected from anonymous wireless devices, and displays these live travel times on roadside portable variable message signs. Based on positive feedback from the initial test, MassDOT proceeded with the development of a statewide expansion. As part of the system rollout, MassDOT is installing travel time signs consistent with *Manual of Uniform Traffic Control Devices*. An example of these signs is shown in Figure 4.12. These signs display the travel time to specific points along the highway. MassDOT currently plans to install this system along I-195.

Figure 4.12. Roadside ITS/Changeable Signage

The changeable signs noted in the section above could be enhanced by an expansion of the "GO Time" system to include the approaches to the bridge. The signs could then include messages similar to the following:

Next Bridge Closing
Scheduled at 2:15 pm
Time to Bridge xx mins

Bridge Closing
in 5 minutes
Time to Bridge xx mins

This information would be relevant for select sign locations , such as those along I-195 or at the Route 6/Route 240 intersection where the distance between the sign would allow for more accurate measurements. Additionally when the bridge is either not open or is in the opening process, the utilization of Bluetooth travel time prediction technology would not provide accurate results.

An important part of the "GO Time" system is that real-time travel data will be made available through an open data strategy to web and smartphone app developers. This open data strategy allows for the development of smartphone apps and further distribution of travel data. Integration of the bridge with the "GO Time" system would allow for more information to be made available.

Assuming the other ITS/changeable signs noted above are already installed the cost to integrate bridge signs into the "GO Time" system is estimated to be approximately $100,000.

5 Recommendations

5.1 SUMMARY OF RECOMMENDATIONS

The purpose of the New Bedford-Fairhaven Bridge Corridor Study is to evaluate multi-modal transportation and associated land use issues, develop potential solutions, and to recommend improvements along the Route 6 Corridor between County Street in New Bedford and Adams Street in the Town of Fairhaven. The focus of the study was on identifying and analyzing options to replace the swing span of the New Bedford-Fairhaven Bridge and comparing the impacts of these replacement build alternatives with a no build option. A set of goals and objectives, outlined in Chapter 1, provided the framework for the development of alternatives as part of this study. A set of evaluation criteria tied to the goals and objectives were established to assess the benefits and impacts of the alternatives.

Based on public comment and input from the SAG, a set of short-term, medium-term, and long-term recommendations were developed. Two of the eight long-term alternatives developed and analyzed as part of this study are recommended for further analysis and advancement into the MassDOT Project Initiation and Environmental, Permitting, and ROW Process. The two recommended alternatives offer the benefits of greater horizontal and navigational clearances and have the least impacts compared to the other alternatives:

- **Alternative 1T: Tall Vertical Lift Bridge (150 feet vertical clearance).** Construction of a new vertical lift bridge with 270 feet horizontal clearance in place of existing swing span. The estimated capital cost is $100 to $130 million and the construction duration is 37 months.
- **Alternative 3D: Double-leaf Dutch-style Bascule Bridge.** Construction of a new double-leaf Dutch-style bascule bridge with 200 feet horizontal clearance in place of existing swing span. The estimated capital cost is $100 to $125 million and the construction duration is 26 to 28 months.

Several intersection improvements, bicycle-pedestrian improvements, and ITS/signage improvements are recommended for the short- and medium-term.

- **Corridor intersection improvements.** Short-term signal changes at intersections including changes to cycle length, timing splits or phasing, and coordination offset modifications are recommended once ongoing roadway construction projects are completed in late 2015.
- **Bicycle and pedestrian improvements.** Bicycle or pedestrian improvements are recommended for implementation once the ongoing roadway construction projects are completed in late 2015:
    - Bicycle and pedestrian path along Route 6 from Pleasant Street to Route 18;
    - New pedestrian ramp/staircase between Route 6 and MacArthur Drive; and
    - Completion of sidewalk network along MacArthur Drive.

- **Variable message/ITS signage.** The addition of one or more of the following short- and medium-term alternatives is recommended to complement the existing ITS/signage system:
    - Complete Replacement of Existing System;
    - Expansion of ITS/Signage System; and/or
    - Upgrades to the ITS/Signage System.
- **Short-term signage and pavement marking evaluations.** – Original plans for signage and pavement markings to be installed upon the completion of the current construction activities will be evaluated. Items to be evaluated will include the restoration and configuration of the Pope's Island crosswalk and the potential for "no idling" signs along the swing bridge roadway approaches.

This chapter provides a summary of the long-term alternatives considered, the evaluation process, and a description of the process taken to identify the long-term recommended alternatives that were selected for advancement into the next stages of MassDOT's Project Development and Design Process. The development and proposed implementation of the short- and medium-term alternatives is also discussed. The chapter also highlights the environmental considerations, establishes the policy context, and outlines economic benefits of the recommended alternatives. Additional actions needed to advance the project, required coordination, and future considerations for alternative refinement are also discussed.

5.2 LONG-TERM ALTERNATIVES CONSIDERED

As described in Chapters 3 and 4, the study team developed a set of long-term alternatives based on an initial analysis and screening process. This process included a review of conclusions from a number of previous studies, physical limitations of the bridge approaches and clearance issues, and an assessment of the 2014 Existing Condition and the 2035 No Build Condition. The alternatives were then refined during the alternative development process using a Study Advisory Group and public input. Eight long-term alternatives were developed:

- **No Build Alternative:** Repair Existing Swing Bridge;
- **Alternative 1:** Vertical Lift Bridge (110-135 feet vertical clearance);
- **Alternative 1T**: Tall Vertical Lift Bridge (150 feet vertical clearance);
- **Alternative 2:** Double-leaf Bascule Bridge (Standard);
- **Alternative 2W:** Wide Double-leaf Bascule Bridge (Standard);
- **Alternative 3:** Single-leaf Rolling Bascule Bridge;
- **Alternative 3W:** Double-leaf Rolling Bascule Bridge; and
- **Alternative 3D:** Double-leaf Dutch-Style Bascule Bridge.

A brief summary of each alternative is provided below, along with an alternative comparison matrix that highlights the key differences between the alternatives. A full description and analysis of each long-term alternative based on the evaluation criteria established at the beginning of the study is provided in Chapter 4.

5.2.1 Summary of Long-Term Alternatives

The navigational clearance, vertical clearance, construction duration, and capital costs for each long-term alternative is described below. Implementation of the long-term alternatives is described in later sections of this chapter.

NO BUILD ALTERNATIVE: REPAIR EXISTING SWING BRIDGE

This alternative includes the continued maintenance of the existing swing bridge and repair of the bridge superstructure in the same configuration as currently exists. The construction phase of this project would be approximately 18 months. This alternative would allow for keeping two lanes open for most of the time to vehicular traffic. One of the two existing navigational channels would be open for most of the construction duration. The estimated cost for the No Build Alternative is $45 million. This capital cost would include bridge design and permitting, removal of the existing swing truss structure, and replacement with a newly constructed structure.

ALTERNATIVE 1: VERTICAL LIFT BRIDGE

This alternative constructs a new vertical lift bridge in place of the existing swing bridge. The bridge would include approximately 270 feet of navigational clearance and would allow for approximately 110-135 feet of vertical clearance. The bridge is aligned so that the new 170-foot-high pier towers are approximately in the same location as the east and west abutments of the existing swing bridge. The construction phase of this project would be approximately three years long, or 33 to 36 months. This alternative would allow two or three traffic lanes to remain open for most of the time to vehicular traffic. Both of the existing navigational channels would be open for most of the construction duration. The estimated cost for Alternative 1 is between $90 and $120 million. This capital cost includes the bridge design and permitting, removal and demolition of the existing swing span, and construction of the new bridge span.

ALTERNATIVE 1T: TALL VERTICAL LIFT BRIDGE

This alternative constructs a new vertical lift bridge in place of the existing swing bridge. The bridge would include approximately 270 feet of navigational clearance and would allow for approximately 150 feet of vertical clearance. The new 200-foot-high pier towers are approximately in the same location as the east and west abutments of the existing swing bridge. The construction phase of this project would be approximately three years long, or 33 to 36 months. This alternative would allow two or three traffic lanes to remain open for most of the time to vehicular traffic. Both of the existing navigational channels would be open for most of the construction duration. The estimated cost for Alternative 1T is between $100 and $130 million. This capital cost would include the bridge design and permitting, removal and demolition of the existing swing span and construction of the new bridge.

ALTERNATIVE 2: DOUBLE-LEAF BASCULE BRIDGE (STANDARD)

This alternative constructs a new double-leaf bascule bridge in place of the existing swing bridge. The bridge would include approximately 150 feet of navigational clearance and would have no vertical clearance restrictions with the bridge in the open position. The bridge would be aligned with the east bascule pier in the same location as the existing eastern abutment of the swing bridge. The construction phase of this project would take approximately 37 months. This alternative would consist of closing the bridge to vehicular traffic for approximately two years during that period. One of the two existing navigational channels would be open for most of the construction duration. The estimated cost for Alternative 2 is between $85 and $100 million. This capital cost would include the bridge design and permitting, removal and demolition of the existing swing span and construction of the new bridge.

ALTERNATIVE 2W: WIDE DOUBLE-LEAF BASCULE BRIDGE (STANDARD)

This alternative constructs a new wide double-leaf bascule bridge in place of the existing swing bridge. The bridge would include approximately 220 feet of navigational clearance and would have no vertical clearance restrictions. The bridge would be aligned with the east bascule pier in the same location as the existing eastern abutment of the swing bridge. The construction phase of this project would take approximately 37 months. This alternative would consist of closing the bridge to vehicular traffic for approximately two years during that period. One of the two existing navigational channels would be open for most of the construction duration. The estimated cost for Alternative 2W is between $130 and $160 million. This capital cost would include the bridge design and permitting, removal and demolition of the existing swing span and construction of the new bridge.

ALTERNATIVE 3: SINGLE-LEAF ROLLING BASCULE BRIDGE

This alternative constructs a new single-leaf rolling bascule bridge in place of the existing swing bridge. Rolling bascule bridges are different from the standard bascule in that the counter-weights are located above the roadway surface and the spans segments are lifted by rolling the bridge into the up position along rails or plates located along the approaches. The bridge would include approximately 150 feet of navigational clearance and would not restrict vertical clearance. The bridge would be aligned with the east bascule pier in the same location as the existing eastern abutment of the swing bridge. The construction phase of this project would be a little over two years long, or approximately 26-28 months. This alternative allows two vehicular lanes to remain open for most of the construction phase. One of the two existing navigational channels would be open for most of the construction duration. The estimated cost for Alternative 3 is between $50 and $70 million. This capital cost would include the bridge design and permitting, removal and demolition of the existing swing bridge and construction of the new bridge.

ALTERNATIVE 3W: DOUBLE-LEAF ROLLING BASCULE BRIDGE

This alternative constructs a new double-leaf rolling bascule bridge in place of the existing swing bridge. Rolling bascule bridges are different from the standard bascule in that the counter-weights are located above the roadway surface. The bridge would include approximately 220 feet of navigational clearance and would not restrict vertical clearance when the bridge is in the open position. The bridge would be aligned with the east bascule pier in the same location as the existing eastern abutment of the swing bridge. The construction phase of this project would be a little over two years long, or approximately 26-28 months. This alternative would allow for keeping two lanes open for most of the time to vehicular traffic. One of the two existing navigational channels would be open for most of the construction duration. The estimated cost for Alternative 3W is between $90 and $110 million. This capital cost would include the bridge design and permitting, removal and demolition of the existing swing bridge and construction of the new bridge.

ALTERNATIVE 3D: DOUBLE-LEAF DUTCH BASCULE BRIDGE

This alternative constructs a new double-leaf Dutch-style bascule bridge in place of the existing swing bridge. Dutch-style bascule bridges are different from the standard bascule in that the counter-weights are located above the roadway surface. As opposed to rolling bascule bridges, the bridge deck of a Dutch-style bascule bridge is lifted using a system that combines the counter-weight, an overhead beam and pivot points, or heel trunnions, for both the beam and the bridge deck. The bridge would include approximately 200 feet of navigational clearance and would not restrict vertical clearance. The bridge would be aligned with the east bascule pier in the same location as the existing eastern abutment of the swing bridge. The construction phase of this project would be a little over two years long, or approximately 26-28 months. This alternative would allow for keeping two lanes open for most of the time to vehicular traffic. One of the two existing navigational channels would be open for most of the construction duration. The estimated cost for Alternative 3D is between $100 and $125 million. This capital cost would include the bridge design and permitting, removal and demolition of the existing swing bridge and construction of the new bridge.

5.2.2 Evaluation Criteria Summary

As discussed in Chapters 1 and 4, a set of evaluation criteria were established at the study onset to help analyze the long-term alternatives. These evaluation criteria addressed the following topics:

- Bridge Operations (i.e., vertical clearance, number of openings);
- Transportation Impacts (i.e., vehicle delay, connectivity);
- Safety (i.e., emergency vehicle access, navigational safety);
- Economic Development (i.e., shipper cost savings);
- Environment (i.e., coastal or wetland resource impacts);
- Community (i.e., open space or cultural resource impacts); and
- Alternative Feasibility (i.e., costs, construction duration).

Each long-term alternative was evaluated using these criteria. In addition to the quantitative or qualitative information provided, a rating system was used to identify the significance of the impact or benefit. The following is the legend for the rating system utilized:

● = Minor Negative Impact or Most Positive Benefit

◒= Moderate Impact or Minor/Moderate Positive Benefit

○= Significant Negative Impact or Least Positive Benefit

The complete evaluation summary tables are presented in Chapter 4 for all eight long-term alternatives. Tables 5.1 and 5.2 provide a brief comparison matrix that identifies the "differentiators" that were used to identify the primary benefit or constraint of each long-term alternative. The red cells in the following tables identify the primary or most noteworthy difference among the alternatives. The yellow cells highlight the secondary difference among the alternatives.

Table 5.1. Alternative Comparison Matrix (Alternatives 1, 1T, 2, and 2W)

Evaluation Criteria	Alternative 1: Vertical Lift Bridge (Rating)	Alternative 1T: Vertical Lift Bridge (Rating)	Alternative 2: Double-Leaf Bascule Bridge (Rating)	Alternative 2W: Double-Leaf Bascule Bridge (Rating)
Feet of vertical clearance (vessel height)	110-135 feet ○	150 feet ○	Unlimited ●	Unlimited ●
Feet of horizontal clearance (vessel width)	270 feet ●	270 feet ●	150 feet ◒	220 feet ◒
Impact to safe navigation	Greatly Improved ●	Greatly Improved ●	Moderately Improved ◒	Greatly Improved ●
Visual impacts	Some Impact ○	Some Impact ○	No Impact ●	No Impact ●
Long-term reliability risk	Medium Risk ◒	Medium Risk ◒	Medium Risk ◒	Medium Risk ◒
Capital costs	$90-$120 Million ○	$100-$130 Million ○	$85-$100 Million ◒	$130-$160 Million ○
Annual operating and maintenance costs	$490,000 ◒	$490,000 ◒	$490,000 ◒	$490,000 ◒
Construction duration	33 months ○	33 months ○	37 months ○	37 months ○
Construction phase impacts to vehicular traffic	2 week road closure ●	2 week road closure ●	24 month road closure ○	24 month road closure ○
Construction phase indirect impacts to abutting businesses	Significant access impacts ○	Significant access impacts ○	Significant access impacts ○	Significant access impacts ○

Table 5.2. Alternative Comparison Matrix (Alternatives 3, 3W, 3D, and No Build)

Evaluation Criteria	No-Build: Repair Existing Swing Bridge	Alternative 3: Single-Leaf Rolling Bascule Bridge (Rating)	Alternative 3W: Double-Leaf Rolling Bascule Bridge (Rating)	Alternative 3D: Double-Leaf Dutch-Style Bascule Bridge (Rating)
Feet of vertical clearance (vessel height)	Unlimited ●	Unlimited ●	Unlimited ●	Unlimited ●
Feet of horizontal clearance (vessel width)	95 feet ○	150 feet ◒	220 feet ●	200 feet ●
Impact to safe navigation	N/A	Moderately Improved ◒	Greatly Improved ●	Greatly Improved ●
Visual impacts	N/A	Limited Impact ◒	Limited Impact ◒	Limited Impact ◒
Long-term reliability risk	Medium Risk ◒	High Risk ○	High Risk ○	TBD

Evaluation Criteria	No-Build: Repair Existing Swing Bridge	Alternative 3: Single-Leaf Rolling Bascule Bridge (Rating)	Alternative 3W: Double-Leaf Rolling Bascule Bridge (Rating)	Alternative 3D: Double-Leaf Dutch-Style Bascule Bridge (Rating)
Capital costs	$45 Million ●	$50-$70 Million ●	$90-$110 Million ◒	$100-$125 Million ◒
Annual operating and maintenance costs	$400,000 ●	$400,000 ●	$490,000 ◒	$490,000 ◒
Construction duration	18 months ●	26 months ◒	26 months ◒	26 months ◒
Construction phase impacts to vehicular traffic	2 week road closure ●	3 month road closure ◒	3 month road closure ◒	3 month road closure ◒
Construction phase indirect impacts to abutting businesses	Minor-Moderate access Impacts ●	Moderate access impacts ◒	Moderate access impacts ◒	Moderate access impacts ◒

As shown in the previous tables, the primary differentiators between the long-term alternatives are the issues regarding height or vertical clearance limitations, construction duration and lengthy roadway closures, long-term reliability concerns, and navigational width constraints.

- **Height/Vertical Clearance Limitations.** Unlike all the other alternatives, Alternative 1 and 1T are vertical lift bridges that have vertical underclearance constraints when the bridge is open to vessels.
- **Horizontal Clearance Limitations.** All of the build alternatives increase the horizontal clearance of the bridge opening. The No Build Alternative does not increase the horizontal navigational width from 95 feet. A wider navigational clearance is desired to reduce vessel delays and lower shipping costs. Two of the alternatives, Alternative 2 and 3, increase the width to 150 feet. The five other alternatives offer wider navigational widths, between 200 and 270 feet.
- **Construction Duration/Roadway Closures.** The construction duration varies greatly between alternatives, including the length of roadway closures. The construction duration for the No Build Alternative is 18 months while the two double-leaf bascule bridges (Alternatives 2 and 2W) require a three-year-plus construction period. These two standard bascule bridges require extensive in-water work that will also require a two-year complete roadway closure. This compares to the other alternatives that would require a two-week-long or three-month-long roadway closure.
- **Capital Costs.** Another primary differentiator is the capital costs, which range from a low of $45 million in the No Build Alternative to $130-160 million for Alternative 2W (Wide Double-leaf Bascule Bridge).
- **Long-term Reliability Risk.** The other primary difference between alternatives is the long-term reliability risk. Some moveable bridge types are at a greater risk of inoperability than other types due to the nature of their design and the climate that they operate within. Due to the span width and length required, Alternatives 3 and 3W (rolling bascule bridges) were determined to have higher risks for long-term reliability. The long-term reliability of Alternative 3D, the Double-leaf Dutch-style

Bascule Bridge, is unknown at this time due to the limited number of comparable bridges with similar span widths and lengths.

5.3 SHORT/MEDIUM-TERM ALTERNATIVES CONSIDERED

In addition to the long-term alternatives for the replacement of the New Bedford-Fairhaven Bridge, a number of short-term (less than five years) and medium-term (less than ten years) improvements have been considered and analyzed as part of the study. These improvements are divided into three areas: intersection improvements, bicycle-pedestrian improvements and ITS/signage improvements. More detailed analysis is provided in Chapter 4, including the potential impacts, benefits, and costs of each improvement.

5.3.1 Corridor Intersection Improvements

A number of short-term improvements were analyzed at intersections along the corridor. These changes would be relatively quick to implement with minor costs and could provide immediate benefits to operations along the corridor. The improvements are also expected to benefit the corridor if long-term closure of the bridge is required for construction. Analysis indicated that signal-related intersection improvements would be beneficial at nine corridor intersections between Cottage Street in New Bedford and Adams Street in Fairhaven:

- Mill Street and Cottage Street;
- Kempton Street and Cottage Street;
- Mill Street and County Street;
- Kempton Street and County Street;
- Kempton Street/Mill Street and Purchase Street ("Octopus Intersection");
- Huttleston Avenue and Middle Street;
- Huttleston Avenue and Main Street; and
- Huttleston Avenue and Adams Street.

The improvements would include changes to cycle length, timing splits or phasing, and coordination offset modifications. Since these improvements are all limited to signal timing, it is anticipated that the cost would be limited to the labor costs to make the changes. Implementation of these intersection improvements could commence as soon as the ongoing bridge construction and Kempton Street/Mill Street and Purchase Street improvements are completed in late 2015. Depending upon the procedures used to make the changes, costs would be less than $20,000 to complete changes at all intersections .

5.3.2 Bicycle/Pedestrian Improvements

As described in more detail in Chapter 4, three bicycle and pedestrian improvements have been identified for the corridor. Implementation of these improvements could commence as soon as the ongoing bridge construction and Kempton Street/Mill Street and Purchase Street improvements are completed in late 2015. Timing of the following improvements would depend on funding availability:

- **Bicycle and pedestrian path along Route 6 from Pleasant Street to Route 18.** A pedestrian path that provides a more direct path for pedestrians between the Kempton Street/Mill Street and Purchase Street and the Route 18/Elm Street intersection is recommended for the corridor. The recommended 10- to 12-foot-wide path would be located on the south side of the Route 6 within the existing right-of-way (ROW). A four- to six-foot-high fence would be installed to provide separation between the new path and the eastbound Route 6 travel lanes. The estimated cost for this 0.25-mile long multi-use path is $350,000. To ensure that safety is maintained along the corridor, design of the path would require appropriate roadway separation, fencing, and lighting.
- **New pedestrian ramp and staircase between Route 6 and MacArthur Drive.** A new ramp for pedestrians and bicyclists is recommended to replace an existing staircase that connects the end of the sidewalk on the north side of the Route 6 to MacArthur Drive. The new ADA-compliant ramp would provide a safe and direct connection for bicyclists and pedestrians on the north side of the roadway. The estimated cost for the ramp structure is $450,000.
- **Completion of sidewalk network along MacArthur Drive**. A new sidewalk is recommended along an 85-foot-long segment on the west side of MacArthur Drive just north of Route 6. By adding this one sidewalk segment, a gap in the local pedestrian network would be closed. It is anticipated that MacArthur Drive will become the primary pedestrian route from downtown New Bedford and Route 6 to the proposed Whale's Tooth Commuter Rail Station located north of the corridor. The estimated construction cost of the sidewalk is $15,000, but it is anticipated that funding will be needed for the required additional property rights needed for its construction.

Additionally, all of the long-term build alternatives would allow for a wider bridge with a 64-foot-wide ROW. As part of this additional bridge width, four 11-foot-wide vehicular travel lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks would be constructed. The addition of bike lanes across the New Bedford-Fairhaven Bridge would provide a key link in the proposed 50-mile continuous South Coast Bikeway proposed between Swansea and Wareham, Massachusetts. As described in more detail in Chapter 2, the South Coast Bikeway is part of the larger Bay State Greenway and the East Coast Greenway.

5.3.3 Variable Message/ITS Signage

As previously discussed in Chapter 4, none of the long-term alternatives would reduce the number of daily bridge openings or the delay times for motorists due to the openings. Consequently, providing sufficient notifications about bridge openings would allow motorists to make appropriate detour route selections. The existing ITS/signage system located in close proximity to the bridge approaches is helpful (see locations in Figure 4.10), but is not sufficient to allow for appropriate route selection for many local and regional travelers.

The existing ITS/signage system would result in increased benefits by implementing one or more of the following short- and medium-term alternatives:

- **Complete replacement of existing system.** This short-term alternative includes the complete replacement of the existing signage with signs that allow changeable messages. This information would benefit area travelers by providing additional information regarding the status of the bridge. The system information would be schedule-based or provided (through a semi-automated system) from the bridge operator. The estimated cost for this type of system is estimated to be approximately $750,000 to $1,000,000 and would depend upon the specific sign type and the design for the associated communications system. The replacement system is in the planning stages with MassDOT.
- **Expansion of ITS/signage system**. In addition to replacement of the existing signs, this medium-term alternative includes the expansion of the system to provide additional information to travelers at locations where they could make diversion decisions. Additional signs would be provided on I-195 and at three intersections along Route 6 (Route 240, Middle Street, and Adams Street) in Fairhaven. The estimated cost for the expansion of the system is $400,000.
- **Upgrades to the ITS/signage system.** This medium-term alternative includes upgrades to the replacement system with more advanced technology that would allow signs to provide additional information regarding travel time to the bridge and the bridge status. This system is similar to the MassDOT "GO Time" System that relies on Bluetooth-based real time traveler information to provide travel times. These types of signage are relevant for select sign locations, including along I-195 and the Route 240/Route 6 intersection. Assuming the other ITS/changeable signs noted above have already been installed, the cost to integrate bridge signs into the "GO Time" system is estimated to cost approximately $100,000.

5.4 ALTERNATIVES RECOMMENDED FOR ADVANCEMENT

Taken as a whole, the recommended short-, medium-, and long-term actions comprise a comprehensive set of transportation improvements and policies to meet the needs of the New Bedford-Fairhaven Bridge corridor. The recommendations were selected based on input from the SAG and public comments received during study meetings and in response to the draft study report. A complete list of comments received and responses given are included in Appendix G.

Each of the recommended actions serves an independent function and can be implemented separately as resources allow. They include relatively low-cost and easy to implement actions, such as new sidewalk connections and intersection signal changes. They also include some actions that require no new ROW and have no expected environmental impacts, such the new pedestrian and bicycle ramp and new variable message or ITS signage. Finally, they also include a major infrastructure improvement that has significant capital costs and design and permitting requirements (i.e., the recommended long-term build alternative to replace the existing swing span of the New Bedford-Fairhaven Bridge).

As described later in this chapter, implementation of the recommendations described in the next section will require coordination between a number of agencies. Given transportation funding constraints, the recommended improvements, especially major infrastructure projects, would need to be integrated into other local and regional transportation planning programs.

5.4.1 Recommended Long-Term Alternatives

As documented in Chapter 3, a broad range of alternatives was developed to address the long-term options for the New Bedford-Fairhaven Bridge. The alternatives were evaluated and reviewed by MassDOT, the Study Advisory Group, and community and public stakeholders through a series of meetings to identify feasible solutions.

Based on this review, it was determined that of the eight long-term alternatives considered, two build alternatives have the potential to provide the most effective long-term option. These two options were recommended for advancement because they would result in the least impacts as compared to the other alternatives, while offering the benefits of greater horizontal and navigational clearances. However, additional information, design, and analysis are needed before determining a preferred alternative. The two alternatives recommended for advancement into the project development phase are:

- **Alternative 1T: Tall Vertical Lift Bridge, and**
- **Alternative 3D: Double-leaf Dutch Bascule Bridge.**

Described in more detail in the implementation section of this chapter, the Preliminary Design phase is the first phase of Step 4: Environmental Permitting, Design, and Right-of-Way Process in MassDOT's Project Development and Design Process. Two additional studies should be undertaken as part of the Preliminary Design phase, which is done concurrently with the National Environmental Policy Act (NEPA) permitting process. These additional studies are required to more fully understand site-specific details and navigational issues before a specific bridge type could be identified as the preferred alternative:

- **Bridge Type Study.** After collecting site-specific details (site survey, geotechnical data, force, and load criteria), MassDOT would undertake a study during the Preliminary Design phase to assess the design feasibility of each bridge type and respective costs.
- **U.S. Coast Guard Navigational Evaluation.** As part of the NEPA permitting process, this evaluation would be conducted to determine the ability of the recommended bridge alternatives to meet current and future navigational needs concerning horizontal and vertical clearances.

5.4.2 Short- and Medium-Term Recommendations

The short- and medium-term recommendations include:

- **Corridor intersection improvements.** A number of short-term improvements including changes to signal cycle length, timing splits or phasing, and coordination offset modifications are recommended once ongoing roadway construction projects are completed in late 2015.
- **Bicycle and pedestrian improvements.** The following bicycle or pedestrian improvements could commence as soon as the ongoing roadway construction projects are completed in late 2015:

  - Bicycle and pedestrian path along Route 6 from Pleasant Street to Route 18;
  - New pedestrian ramp and staircase between Route 6 and MacArthur Drive; and
  - Completion of sidewalk network along MacArthur Drive.
- **Variable message/ITS signage.** Additions of one or more of the following short- and medium-term alternatives is recommended to complement the existing ITS/signage system:
  - Complete replacement of existing system;
  - Expansion of ITS/signage system; and/or
  - Upgrades to the ITS/signage system.

As part of the study public comment process, it was identified that the signage and pavement marking plans for the completion of the current construction may warrant reconsideration. Since the importance of the pedestrian environment within the corridor has been highlighted as part of this study, another evaluation of the planned locations and configurations of crosswalks appears warranted. Additionally, it was noted that "no-idling" signs along the swing bridge roadway approaches may improve local air quality. Further evaluation of the legal and safety considerations would be required before signage directing motorists to turn-off their engines within the traveled is recommended.

- **Short-term signage and pavement marking evaluations.** – Evaluate restoration and configuration of the Pope's Island crosswalk and the potential for "no idling" signs along the swing bridge roadway approaches.

5.5 POLICY CONTEXT

The New Bedford-Fairhaven Bridge Corridor Study has been conducted in the context of national and state transportation policy and planning principles. These planning principles and policy positions seek to balance the transportation needs of all facility users and provide a forum to any interested party to provide input to the decision-making process. For this study, the Goals, Objectives, and Evaluation Criteria were developed at the beginning of the study process to take into account transportation needs, economic development, and potential impacts. These Goals, Objectives, and Evaluation Criteria were also developed to support the following state and federal policies and regulations:

- MassDOT's GreenDOT Policy and the GreenDOT Implementation Plan, which embraces the goals that will include the design of a multi-modal transportation system, promote healthy transportation and livable communities, and to triple the share of travel demand by bicycling, transit, and walking.
- The Massachusetts Healthy Transportation Compact and MassDOT's Healthy Transportation Policy Directive requires that all MassDOT projects not only accommodate, but also actively promote healthy transportation modes. The Healthy Transportation Policy Directive is an agreement between MassDOT, the Executive Office of Health and Human Services, the Secretary of Energy and Environmental Affairs, and the Massachusetts Department of Public Health. This legislation is designed to facilitate transportation decisions that balance the needs of all users,

expands mobility, improves public health, and supports a cleaner environment. The Healthy Transportation Policy Directive provides specific guidance on Complete Streets Design Guidelines. MassDOT's Complete Streets approach requires balancing the use of the public right-of-way for all transportation modes, requires that MassDOT projects provide safe and accessible options for all travel modes for all ages and abilities, and emphasizes a multi-modal philosophy.

- Federal regulations including the Federal Highway Administration's (FHWA) oversight of Route 6 as part of the National Highway System. All highways on the NHS, must comply with applicable federal regulations. These requirements include design standards, contract administration, State-FHWA oversight procedures, Highway Performance Monitoring System reporting, National Bridge Inventory reporting, national performance measures data collection, and outdoor advertisement/junkyard control.

All of these policies reflect the fact that roadways are part of an infrastructure that must serve all users, while being an integral part of surrounding neighborhoods. Providing access for all modes and travelers, considering vulnerable roadway users, enhancing transportation choices, fostering community connectivity and economic development, and ensuring the public health of adjoining residents are important considerations that are recognized through the policies and initiatives described above.

The recommended improvements along the New Bedford-Fairhaven Bridge corridor will implement these goals, themes, policies, and regulations by:

- Improving corridor facilities for bicyclists and pedestrians and provide safe facilities that encourage walking and biking. These improvements will support increased pedestrian and bicycle trips and further the goals set forth in the Massachusetts Healthy Transportation Compact and MassDOT's Healthy Transportation Policy Directive.
- Improving harbor accessibility to some marine users (under 14 feet air draft). A new bridge with an increased vertical clearance would accommodate a more balanced use of the corridor and bridge by pedestrians, bicyclists, motorists, and vessels.
- Allowing for continued and improved access to the waterfront, Marina Park, and the Pope's Island Marina, home of the New Bedford Rowing Center.

5.5.1 MassDOT's GreenDOT Policy & GreenDOT Implementation Plan

Under current conditions, the bicycle and pedestrian conditions along the bridge are less than sufficient to provide safe movement along the corridor. The addition of bicycle and pedestrian facilities would make the area much more accessible. As stated in the GreenDOT Implementation Plan, MassDOT has a "strong commitment to improving networks and connectivity for pedestrians and bicyclists in all communities." This commitment is central to MassDOT's transportation vision as described in the GreenDOT Policy. The GreenDOT Implementation Plan seeks to provide customers with services that increase transportation choices, reduce congestion, and improve air quality. As stated in the plan, "this goal is built around the idea of providing more access to these modes for our customers, having these modes absorb as much future travel demand as possible, and thus leveling off growth of automobile usage." With a more complete multi-modal network provided by this project, pedestrian and bicycling usage would increase along the corridor and potentially reduce the demand for motor vehicles.

5.5.2 Massachusetts Healthy Transportation Compact & MassDOT's Healthy Transportation Policy Directive

The MassDOT Healthy Transportation Policy Directive was issued to "ensure that all MassDOT projects are designed and implemented in a way that all our customers have access to safe and comfortable healthy transportation options." To increase and encourage more pedestrian and bicycle trips, the Healthy Transportation Policy Directive outlines the statewide mode shift goal that seeks to triple the distance travelled by walking, bicycling, and public transit by 2030. According to the directive, MassDOT construction projects "shall include provisions of off-road accommodations (shared-use path, or bridge-side path) or clearly designate safe travel routes for pedestrians, bicyclists, and transit users along existing facilities, including customers that fall under the protection of the Americans with Disabilities Act." The implementation of separate bicycle and pedestrian paths will fulfill these directives as well as encourage overall healthy transportation.

As discussed in more detail in Chapter 2 of this document, the South Coast Bikeway is a 50-mile-long bike or multi-use path proposed between the Rhode Island-Massachusetts border and the Cape Cod Canal. This regional route would connect a number of existing and proposed bicycle paths and on-road bike routes. This route would include an on-road connection over the New Bedford-Fairhaven Bridge with connections to the east and west. The bridge is a critical link between existing segments of the bikeway. It is recommended that improvements to bicycle access and facilities include close coordination with stakeholders, including Southeastern Regional Planning and Economic Development District (SRPEDD), as the project moves through the project development phases. Such coordination will help ensure that the proposed connectivity for bicycles is consistent with other regional plans such as the South Coast Bikeway.

5.5.3 FHWA & National Highway System

The National Highway System (NHS) consists of roadways essential to national economics, defense, and mobility. The NHS includes interstates, principal arterials, and intermodal connectors. Route 6 is functionally classified as an Urban Principal Arterial and is part of the NHS. FHWA has oversight responsibility for the NHS and would be required to review design changes as they relate to the functional classification of the roadway. Although recommended changes are not anticipated to affect the functional classification of Route 6, MassDOT will need to continue to coordinate with a number of local, regional, state, and federal agencies throughout the project development phases. This includes the FHWA, the City of New Bedford, the Town of Fairhaven, SRPEDD, and the Southeastern Massachusetts Metropolitan Planning Organization (SMMPO). This coordination will include roadway changes, such as the potential elimination of the Route 18 off-ramp, and incorporation of non-auto uses along the highway, such as the contemplated bike lanes.

5.5.4 Southeastern Massachusetts Metropolitan Planning Organization

The SMMPO is a transportation policy-making organization made up of representatives from local government and transportation authorities. MPOs were created to ensure that existing and future expenditures for transportation projects and programs were based on a continuing, cooperative and comprehensive (3-C) planning process. SRPEDD serves as the primary technical and support staff to the SMMPO.

Federal funding for transportation projects and programs is channeled through this 3-C process. As this project moves through the project development phases, coordination with the SMMPO will be required to request and allocate funding and to ensure that the project is consistent with other regional and local transportation programs and projects. This includes working with SRPEDD/SMMPO as they prepare an update to the 2012 *Regional Transportation Plan* (RTP). Updated every five years, a RTP is the "needs assessments" of the region's transportation infrastructure. Inclusion within the RTP is necessary for the project to be listed in region's Transportation Improvement Program (TIP) and receive funding.

5.5.5 South Coast Rail

The project will improve access to the South Coast Rail Whale's Tooth Station, which is within the project limits. The *South Coast Rail Economic Development and Land Use Corridor Plan* (June 2009) prepared by SRPEDD and others, updated areas within the South Coast Rail Corridor where communities would like to see growth (Priority Development Areas, or PDA) and areas that communities would like to preserve (Priority Protection Areas, or PPA). The purpose of identifying these priority areas was to target public investments, focus planning activities, and catalyze private development within a coordinated framework. Within the Study Area, Whale's Tooth Station was cited as a community priority area of regional significance.

5.6 ECONOMIC BENEFITS

Increasing the bridge opening could increase the attractiveness of the Port of New Bedford as a destination for large cargo vessels. The existing swing span has been cited as an issue that may be limiting port activity, particularly in the North Harbor. Mitigating the issues surrounding the existing structure would be an important first step to improving the overall harbor.

A portion of the study area is within the New Bedford-Fairhaven Designated Port Area (DPA), one of only eleven DPAs in the state. State policy regarding DPA supports the preservation and enhancement of water-dependent industrial uses." The Massachusetts Office of Coastal Zone Management (CZM) supports proactive planning within DPAs to promote maritime uses and ensure conflicts with other users are minimized since the areas that can support this type of industry are limited given the numerous siting requirements.

Improvements to the bridge could result in increased port economic development potential. The port could not only accept an increased number of commercial fishing vessels, but could also be able to accept new types of cargo from vessels that are currently too large to transit through the

New Bedford-Fairhaven Bridge into the North Harbor. With the expansion of fishing and cargo activity, supporting marine industries would continue to thrive. These industries include cargo-handling, warehousing, refrigeration, seafood processing, welding, ship repair, and fishing supply services. The Port of New Bedford has a number of vacant or underutilized properties that are available to support expansion of these services.

Bridge improvements could also have a uniquely positive impact on costs of business within the Port of New Bedford. A widened bridge opening for vessels to pass through would result in lowered costs associated with reduced weather-related delays. This would result in shipper cost savings for vessels serving the port, an improvement that is important for the continued health or growth of the local and regional marine industry.

A number of existing factors and in-progress developments could work in concert with bridge improvements to create a cohesive and cost-effective regional intermodal freight network centered on the Port of New Bedford. An out-of-use Mass Coastal Railroad rail spur along MacArthur Drive between Herman Melville Boulevard and the State Pier was rehabilitated in 2013. This rail connection provides direct rail access to the State Pier and docks in the North Harbor. This connection would provide a greater range of options for the inland shipping of cargo received by the port. New Bedford has a number of existing competitive advantages for the expansion of its cargo services including its exemption from the Harbor Maintenance Tax, foreign trade zone (FTZ) status, trucking rates, and unique, far-reaching multi-modal transportation network. It also has sufficient area to develop new docks and supporting landside development.

These factors give the Port of New Bedford excellent potential to increase its cargo operations and diversify maritime development. These advantages currently serve the port's vibrant fishing industry, but could also attract investments by other port-related industries. Promoting the advantages of the Port of New Bedford and making key infrastructure investments could support a growth in non-fishing companies interested in expanding their cargo operations or changing port destinations.

Specific development opportunities are described in the following sections.

5.6.1 North Terminal

The New Bedford Harbor Development Commission (HDC) is also interested in planning and designing a terminal to the north of the bridge, as part of their longer-term vision for the harbor's development. According to HDC, the North Terminal has the following ideal characteristics for developing water dependent industrial uses in the harbor:

- Adjacent rail for the entire parcel with on-dock rail at the EPA facility;
- The presence of Route 18, which serves as a natural buffer between the North Terminal and housing west of Route 18; and
- Immediate access to an uncongested portion of the interstate system with ready access to New York, Providence, Boston and points west via Route 18.

The North Terminal Extension Phase One (NTE1) entails the construction of a 400-600 foot sheet pile, heavy-load bulkhead in the northern area of New Bedford Harbor. The project will build on existing EPA clean-up efforts, as well as other dredging activities in the harbor, which were included in the 2014 Massachusetts Environmental Bond Bill. The project involves using fill material taken from navigational dredge spoils and, when complete, it will utilize approximately 143,600 cubic yards of clean dredge material as fill to create 4.68 acres of new land. HDC feels strongly that the addition of new bulkhead would increase the competitiveness of the port in a number of ways.

First, the facility would provide a secondary deployment site for offshore wind energy related activity. When the bridge restrictions are addressed, the North Terminal would be well positioned to handle over-sized project cargo, such as wind turbine components. HDC is interested in initiating a planning and design effort now, to position the port to be competitive as wind energy activity grows in and around New Bedford.

Second, fishing vessels and fish processors are increasingly using New Bedford as a base for their operation. The North Terminal facility would create room for 24-30 additional fishing vessels, meeting a well-documented need for new dockage. According to HDC's Commercial Fishing Fleet Berthing Plan prepared in March 18, 2008, the port has public berths for only 160 vessels. The port currently has 470 commercial fishing vessels. Space for the existing New Bedford-based fleet is already limited, with multiple vessels often "rafting" to secure pier access. Between two and four vessels typically raft abreast at each berth, with up to six or more vessels rafted together during storms. Overcrowding of the berthing facilities creates safety concerns for vessels, crew, and landside facilities.

Third, NTE1 will be able to handle additional conventional cargo opportunities. The site already features on-dock rail access at the adjacent EPA Dewatering Facility, making the port more competitive for project cargoes and other products that utilize the rail. This facility will also be able to handle freight service to the islands of Martha's Vineyard and Nantucket. Currently, all of that cargo is trucked on state roads through Woods Hole and Hyannis. Establishing further cargo service from New Bedford to the islands would result in significant emissions reductions, less traffic congestion, and fewer trucks on seasonally busy local roads on Cape Cod and the islands.

Fourth, the project would increase the return on a range of recent Commonwealth and federal government investments in New Bedford. The North Terminal facility would complement the New Bedford Marine Commerce Terminal and provide shippers with direct access to the nation's freight railroad network over the significant rail investments MassDOT has already made, including new railroad ties on the New Bedford line and a new Wamsutta Bridge. It would also take advantage of the rail siding at the EPA's Dewatering Facility, built in 2003.

The recommended bridge alternative, in combination with the planned dredging near the proposed North Terminal, would support HDC's economic development plans by resolving many of the navigational issues cited throughout this alternatives analysis. It is recommended, depending on the navigational width provided as part of a future bridge project, that a fendering system be considered. This system would further mitigate pilot concerns related to vessel navigation in the North Harbor.

HDC is also studying options for modifying the State Pier to improve functionality of the facility and reefer storage. Completing local and regional rail system improvements and advancing discussions regarding local facility management are also key HDC initiatives. Resolving the constraints associated with the current bridge is a critical first step to the greater economic development vision of the HDC.

5.6.2 Wind Industry

One industry with significant economic potential in New Bedford is the development of the wind industry. There are a number of sites with redevelopment potential available along the harbor for industrial use. New Bedford Harbor would be an ideal site for the manufacturing and assembling of industrial components for offshore wind facilities. New Bedford is the largest and closest port to the potential offshore wind sites in Nantucket Sound. The ability to manufacture these large-scale components at the site of transit would offer a significant cost savings for initial construction and long-term maintenance costs for the operators, while also benefiting the study area with long-term ongoing economic participation in wind operations and maintenance (Ports of MA Strategic Plan). According to the *Port and Infrastructure Analysis for Offshore Wind Energy Development* report prepared by the Massachusetts Clean Energy Center in 2010, a bridge with a vertical clearance of at least 150 feet and a horizontal clearance of at least 150 feet would likely allow this unique manufacturing opportunity to be feasible in the North Harbor. It could also encourage new development in the North Harbor. Moreover, a stable manufacturing site could help to reduce the impact of seasonality on employment in the Port, and the city of New Bedford as a whole.

5.6.3 Hicks-Logan-Sawyer District

The Hicks-Logan-Sawyer District is a waterfront neighborhood on the northwest corner of the North Harbor, directly south of the I-195 bridge. This neighborhood has great redevelopment potential that would be bolstered by investment in the New Bedford-Fairhaven Bridge. The district is a true mixed-use area, containing industrial, commercial, and residential sites. Current industrial use includes three major mill buildings, a tire recycling facility, seafood-processing sites, and several light manufacturing sites.

The district is well connected to the local transportation network, including direct access to I-195. It is a 30-minute ride to the I-95 corridor, a key advantage for residents as well as commercial and industrial interests. A considerable amount of both vacant buildings and undeveloped free space currently exists within the neighborhood. The City of New Bedford's designation of the Wamsutta Mill Overlay District, at the southern end of the district and adjacent to the North Port marine terminal, encourages new construction within existing facilities, and the rehabilitation of other existing structures to promote economic and cultural redevelopment through residential and commercial use. The area is ripe for the development of supporting industries that would be needed as the port grows. It also has the capacity and free space to host future wind industry sites. Finally, owing to its proximity to downtown New

Bedford, this district has significant potential to capture retail spillover resulting from new downtown development.

5.6.4 Fairhaven

The Fairhaven side of the harbor also stands to benefit from any bridge improvements. Currently, six marinas that primarily serve recreational vessels are located on the east side of the harbor. These marinas have over 580 total individual boat slips (Harbor Plan). Two of these marinas are north of the New Bedford-Fairhaven Bridge. If the vertical clearance was increased to 14 feet, many of these recreational vessels may not have to wait for the bridge to open. This could improve the potential for these recreational marinas to expand. This side of the harbor also features a resilient and growing marine service and vessel repair industry, including the only full-service yacht yard in New England. There are existing commercial and industrial zones along the Fairhaven waterfront. As a result of increased port traffic and overall local revitalization, these boat-servicing facilities can expect to see increased business, and have room to further expand these services.

5.6.5 Tourism and Waterfront Access

Reconstruction of the New Bedford-Fairhaven Bridge could also help to make this historically marine industrial area into an attractive recreational destination. Already offering great views of the ocean and the city, improving the aesthetics of the bridge could bring new recreational visitors, and work together with larger downtown revitalization projects to beautify the area and provide public access to the waterfront. Improved pedestrian and bicycle access to and across the bridge could encourage recreational uses along the waterfront and on Pope's Island. On-road bicycle amenities and signage on the bridge would significantly upgrade bike access. It would also connect the bridge to the greater South Coast Bikeway, which provides a scenic bike route throughout the South Coast region.

5.7 HARBOR PLANNING

5.7.1 Harbor Master Plan

As the alternatives are developed further, it is also recommended that the City of New Bedford initiate a master planning process for the development of the harbor and New Bedford-Fairhaven Bridge study area. The master plan would build on the 2002 New Bedford Harbor Plan. This plan should be prepared in advance of or concurrently with the environmental process for the New Bedford-Fairhaven Bridge project. The plan should ensure that the future needs and plans for the North Harbor are taken into account as the preliminary assessment of the final bridge options and designs are being developed. This master plan would include strategic waterside and landside plans for the North Terminal area and the visions for utilization of other New Bedford waterfront areas, such as the New Bedford State Pier and the Hicks-Logan-Sawyer District. As the City develops a state-approved Harbor Master Plan in accordance with 301 CMR 23.00, coordination with the Massachusetts CZM and Massachusetts Department of Environmental Protection (MassDEP) would be required. Massachusetts CZM is responsible for supporting planning to promote maritime development, prevent user conflicts, and accommodate supporting industrial and commercial uses. The Massachusetts DEP is responsible for permitting uses, fill, and structures in DPAs in accordance with the Harbor Master Plan.

5.7.2 New Bedford Harbor Superfund Site/State Enhanced Remedy

The New Bedford-Fairhaven Bridge is located within the New Bedford Harbor Superfund Site that extends from the shallow northern reaches of the Acushnet River estuary, south through the commercial harbor of the City of New Bedford and the Town of Fairhaven, and into 17,000 acres in Buzzards Bay. The site was listed as a Superfund Site on September 8, 1983 and is contaminated by Polychlorinated biphenyls (PCBs) and heavy metals in underwater subtidal sediment and intertidal sediment.

In 1998, the EPA selected the cleanup plan for the upper and lower harbor by issuing the Operable Unit 1 Record of Decision (OU1 ROD), including dredging of contaminated sediment and disposal in on-site Confined Disposal Facilities (CDFs) to be constructed along the New Bedford shoreline. The EPA has modified the site cleanup plan four times to address new information obtained through additional site investigations. Among the modifications, EPA eliminated the largest CDF in favor of off-site disposal for a portion of sediment and added on-site disposal for the remaining portion of sediment slated for CDF D in a Lower Harbor Confined Aquatic Disposal (CAD) Cell.

In association of the EPA harbor clean-up activities, the Commonwealth of Massachusetts requested that EPA integrate navigational dredging, on-site disposal, and construction of the South Terminal Project into EPA's cleanup plan. These State Enhanced Remedy (SER) activities are integrated into the cleanup plan for the Upper and Lower Harbors and are completely funded by the Commonwealth of Massachusetts. As described in an EPA technical memo "New Bedford Harbor Superfund Site – Brief Summary" issued on September 29, 2014, this SER process has allowed improvements to be made to the harbor while also addressing disposal of sediments with lower levels of PCB-contamination that were not planned to be addressed in the original 1998 plan.

The CAD Cell that is possible through the SER process allows for a way to efficiently dispose of the PCB-contaminated soils. It was determined that this disposal approach reduced both the permitting schedule and the sediment disposal costs dramatically for both the navigational dredging and South Terminal projects. Although sediment disposal costs would not be a substantial part of the New Bedford-Fairhaven Bridge costs for either of the alternatives under consideration, any opportunity to reduce construction costs and the permitting schedule should be explored.

In September 2013, the U.S. District Court approved a landmark $366.25 million cash-out settlement with the company whose predecessor held much of the liability of the contamination of New Bedford Harbor. Due to prior limitations in Superfund funding (which had typically been $15 million per year for the New Bedford Harbor site), the project was expected to take another 40 years. With this 2013 settlement, the harbor project will be accelerated to be substantially completed within five to seven years, or by 2020. The schedules of the harbor clean up and any bridge improvements will need to be evaluated for possible coordination as part of the determination of whether the CAD Cell and SER process could be utilized in advancing bridge improvements.

5.8 IMPLEMENTATION

Transportation decision-making is complex and can be influenced by legislative mandates, environmental regulations, financial limitations, agency programmatic commitments, and collaborating opportunities. Project development is the process that takes a transportation improvement from conception through construction. Decision-makers and reviewing agencies, when consulted early and often throughout the project development process, can ensure that all participants understand the potential impact these factors may have on project implementation.

This section describes how the implementation of the recommended improvements would be coordinated through the MassDOT Project Development and Design Process. The section concludes with an implementation summary table and discussion of the agencies or organizations responsible for implementation for each recommendation.

5.8.1 MassDOT Project Development and Design Process

The MassDOT Highway Division has developed a comprehensive project development process, which is contained in Chapter 2 of the *MassDOT Highway Division's Project Development and Design Guide.* The eight-step process covers a range of activities extending from identification of a project need, completion of a set of finished contract plans, and on through construction of the project. The sequence of decisions made through the project development process progressively narrows the project focus, while developing greater design details, and ultimately leads to a project that addresses the identified needs in the most cost-effective and publicly acceptable way. The New Bedford-Fairhaven Bridge Corridor Study has been structured to meet the first two steps of the project development process: 1) Needs Identification and 2) Planning.
The more-detailed descriptions provided in the following sections are focused on the process for a roadway project, but the same basic process will need to be followed for non-roadway projects as well.

STEP 1: NEEDS IDENTIFICATION

For each of the locations at which an improvement is to be implemented, MassDOT leads an effort to define the problem, establishes project goals and objectives, and defines the scope of the planning needed for implementation. To that end, it has to complete a Project Need Form (PNF), which states in general terms the deficiencies or needs related to the transportation facility or location. The PNF documents the problems and explains why corrective action is needed. For this corridor, the information defining the need for the project will be drawn from the present report and the most recent bridge inspections. At this point in the process, MassDOT also meets with potential participants, such as the MPO and community members, to allow for an informal review of the project. The PNF is reviewed by the MassDOT Highway Division office whose jurisdiction includes the location of the proposed project. For this project, it is District 5. MassDOT also sends the PNF to the MPO for informational purposes. The outcome of this step determines whether the project requires further planning, whether it is already well supported by prior planning studies, whether it is ready to move forward into the design phase, or whether it should be dismissed from further consideration.

STEP 2: PLANNING

This phase will likely not be required for the implementation of the improvements proposed in this planning study, as this planning report should constitute the outcome of this step. However, in general, the purpose of this implementation step is for the project proponent to identify issues, impacts, and approvals that may need to be obtained, so that the subsequent design and permitting processes are understood. The level of planning needed will vary widely, based on the complexity of the project. Typical tasks include: define the existing context, confirm the project need, establish goals and objectives, initiate public outreach, define the project, collect data, develop and analyze alternatives, make recommendations, and provide report documentation. Likely outcomes include consensus on the project definition to enable it to move forward into environmental documentation (if needed) and design, or a recommendation to delay the project or dismiss it from further consideration.

STEP 3: PROJECT INITIATION

Upon completion of this study, the project would be ready to proceed into the Project Initiation phase. As the project proponent, MassDOT Highway Division would need to complete a Project Initiation Form (PIF) for each improvement. A Project Review Committee (PRC) and the MPO, in this case SMMPO, then review the PIF. The PRC is composed of the Chief Engineer, each of the six District Highway Directors, and representatives of the MassDOT Project Management, Environmental, Planning, Right-of-Way, Traffic, and Bridge departments, and the Federal Aid Program Office (FAPO). The PIF documents the project type and description, summarizes the project planning process, identifies likely funding and project management responsibilities, and defines a plan for interagency and public participation. First, the PRC reviews and evaluates the proposed project based on MassDOT's statewide priorities and criteria. If the result is positive, MassDOT Highway Division moves the project forward to the design phase and to programming review by the MPO. The PRC may provide a Project Management Plan to define roles and responsibilities for subsequent steps. The MPO review includes project evaluation based on the MPO's regional priorities and criteria. The MPO may assign a project evaluation criteria score, a Transportation Improvement Program (TIP) year, a tentative project category, and a tentative funding category.

Given transportation funding constraints, prioritization of the recommendations for implementation will need to be established regionally by the SMMPO/SRPEDD in partnership with their member communities and MassDOT, particularly for major infrastructure investments. As part of the ongoing 2016 update to SMMPO's 2012 RTP, recommendations from this study should be evaluated for inclusion into the regional plan. This process will require continued coordination among the transportation agencies, planning organizations, municipalities, and stakeholders represented in the Study Advisory Group.

STEP 4: ENVIRONMENTAL PERMITTING, DESIGN, AND RIGHT-OF-WAY PROCESS

This step has four distinct but closely integrated elements: Public Outreach, Environmental Documentation and Permitting (varying levels, if required), Design, and Right-of-Way Acquisition (if required). The outcome of this step is a fully designed and permitted project ready for construction. The sections below provide more detailed information on the four elements of this step of the project development process.

Public Outreach
Continued public outreach in the design and environmental process is essential to maintain varying levels of public support for the project and to seek meaningful input on the design elements. The public outreach is often in the form of required public hearings (conducted at the 25 percent and 100 percent design milestones), but can also include less formal dialogue with those interested in and affected by a proposed project.

Environmental Documentation and Permitting
The project proponent, in coordination with the Environmental Services section of the MassDOT Highway Division, will be responsible for identifying and complying with all applicable federal, state, and local environmental laws and requirements. This includes determining the appropriate project category for both the Massachusetts Environmental Protection Act (MEPA) and the National Environmental Protection Act (NEPA). Environmental documentation and permitting is often completed in conjunction with the Preliminary Design phase described below.

Design
There are three major phases of design. The first is Preliminary Design, also referred to as the 25 percent submission. The major components of this phase include a full survey of the project area, preparation of base plans, development of basic geometric layout, development of preliminary cost estimates, and submission of a functional design report. Preliminary Design, although not required to, is often completed in conjunction with Environmental Documentation and Permitting.

For the New Bedford-Fairhaven Bridge, the Preliminary Design phase will include a Bridge Type Study to perform a detailed investigation into whether a vertical lift bridge or a double-leaf Dutch-style bascule bridge should be selected for the site. The Bridge Type Study is the process to determine the most appropriate structure type. The study will include a survey of site conditions, hydraulic and geotechnical conditions, environmental considerations. It will also include a preliminary assessment of bridge forces and loads and their functional and cost implications on the two bridge types under consideration.

The recommended alternative identified through the Bridge Type Study would be submitted to the FHWA for concurrence through a NEPA-compliant Environmental Assessment (EA).

In addition to FHWA review, the U.S. Coast Guard will require a Navigational Evaluation. The purpose of this evaluation is to identify and evaluate the ability of the recommended bridge to meet current and future navigational needs concerning horizontal and vertical clearances. When the clearance requirements are not evident, the Navigational Evaluation is produced through an interactive process that includes the bridge owner, the U.S. Coast Guard, and the mariners who frequent the bridge channel to determine the most reasonable clearances for the bridge.

The next phase is Final Design, also referred to as the 75 percent and 100 percent submissions. The major components of this phase include preparation of a subsurface exploratory plan (if required), coordination of utility relocations, development of temporary traffic control plans through construction zones, development of final cost estimates, and refinement and finalization of the construction plans. Once Final Design is complete, a full set of Plans, Specifications, and Estimates (PS&E) is developed for the project.

Right-of-Way Acquisition
A separate set of Right-of-Way plans is required for any project that requires land acquisition or easements. The plans must identify the existing and proposed layout lines, easements, property lines, names of property owners, and the dimensions and areas of estimated takings and easements.

STEP 5: PROGRAMMING (IDENTIFICATION OF FUNDING)

Programming, which typically begins during the design phase, can actually occur at any time during the process, from planning to design. In this step, which is distinct from project initiation, the project proponent requests that the MPO include a project from the Regional Transportation Plan in the region's annual Transportation Improvement Program (TIP) development process. The proponent requesting the project's listing on the TIP can be the community or one of the MPO member agencies (the Regional Planning Agency, MassDOT, or the Regional Transit Authority). The MPO considers the project in terms of state and regional needs, funding availability, project readiness, evaluation criteria, and compliance with the Regional Transportation Plan. If the MPO decides to include the project in the TIP, it is first included in the Draft TIP for public review and then in the Final TIP. A project does not have to be fully designed for the MPO to program it in the TIP, but generally, a project has reached 75 percent design to be programmed in the year-one element of the four-year TIP.

STEP 6: PROCUREMENT

Following project design and programming of a highway project, the MassDOT Highway Division publishes a request for proposals, also referred to as being "advertised" for construction. MassDOT then reviews the bids, and awards the contract to the qualified bidder with the lowest bid.

STEP 7: CONSTRUCTION

After a construction contract is awarded, MassDOT Highway Division and the contractor develop a public participation plan and a temporary traffic control plan for the construction process.

STEP 8: PROJECT ASSESSMENT

The purpose of this step is to receive constituents' comments on the project development process and the project's design elements. MassDOT Highway Division can apply what is learned in this process to future projects.

Table 5.3 contains the summary of these steps along with their effect on the project schedule and lists approximate duration ranges associated with each step.

Table 5.3. MassDOT Highway Division Project Development & Design Guide Process

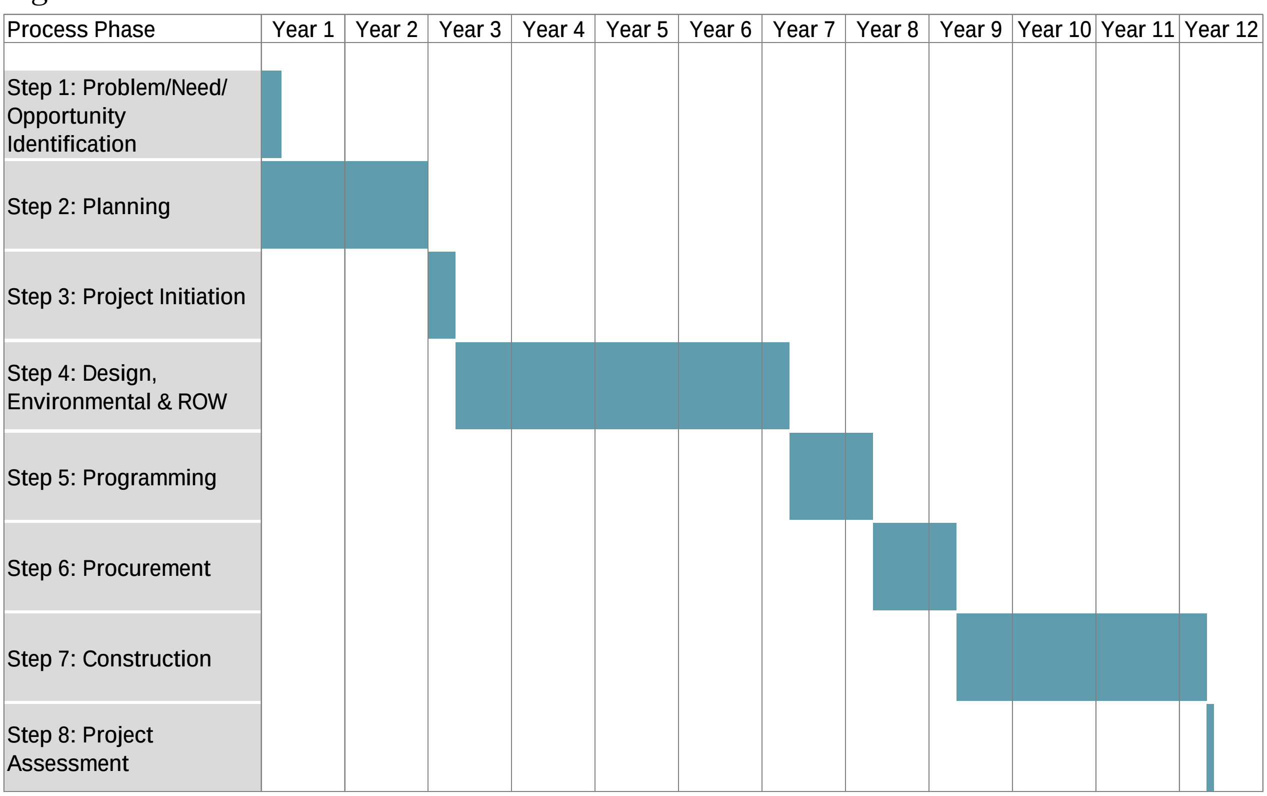
Description	Schedule Influence	Typical Duration
Step 1: Problem/Need/Opportunity Identification The proponent completes a Project Need Form (PNF). This form is then reviewed by the MassDOT District office, which provides guidance to the proponent on the subsequent steps of the process.	The PNF has been developed so that it can be prepared quickly by the proponent, including any supporting data that is readily available. The District office shall return comments to the proponent within one month of PNF submission.	1 to 3 months
Step 2: Planning Project planning can range from agreement that the problem should be addressed through a clear solution to a more detailed analysis of alternatives and their impacts.	For some projects, no planning beyond preparation of the PNF is required. Other projects may require a planning study centered on specific project issues associated with the proposed solution or a narrow family of alternatives. More complex projects will likely require a detailed alternatives analysis.	Project Planning Report: 3 to 24+ months
Step 3: Project Initiation The proponent prepares and submits a Project Initiation Form (PIF) and a Transportation Evaluation Criteria (TEC) form in this step. The PIF and TEC are informally reviewed by the MPO and MassDOT District office, and formally reviewed by the Project Review Committee (PRC).	The PIF includes refinement of the preliminary information contained in the PNF. Additional information summarizing the results of the planning process, such as the Project Planning Report, is included with the PIF and TEC. The schedule is determined by PRC staff review (dependent on project complexity) and meeting schedules.	1 to 4 months
Step 4: Design, Environmental, and Right-of-way The proponent completes the project design. Concurrently, the proponent completes necessary environmental permitting analyses and files applications for permits. Any right of way needed for the project is identified and the acquisition process begins.	The schedule for this step is dependent upon the size of the project and the complexity of the design, permitting, and right-of-way issues. Design review by the MassDOT District and appropriate sections is completed in this step.	48+ months
Step 5: Programming The MPO considers the project in terms of its regional priorities and determines whether to include the project in its Draft Transportation Improvement Program (TIP), which is then made available for public comment. The TIP includes a project description and funding source.	The schedule for this step is subject to each MPO's programming cycle and meeting schedule. It is also possible that the MPO will not include a project in its Draft TIP based on its review and approval procedures.	3 to 12+ months
Step 6: Procurement The project is advertised for construction and a contract awarded.	Administration of competing projects can influence the advertising schedule.	6 to 12 months
Step 7: Construction The construction process is initiated including public notification and any anticipated public involvement. Construction continues to project completion.	The duration for this step is entirely dependent upon project complexity and phasing.	3 to 60+ months

Description	Schedule Influence	Typical Duration
Step 8: Project Assessment The construction period is complete and project elements and processes are evaluated on a voluntary basis.	The duration for this step is dependent upon the proponent's approach to this step and any follow-up required.	1 month

Source: MassDOT Highway Division Project Development and Design Guide

The project development process described previously is based on a conventional project delivery method, commonly referred to as "Design-Bid-Build" (D-B-B). The essence of the D-B-B process is that project is designed to the PS&E level and then advertised for construction (i.e., the design and construction are carried out sequentially). Under this scenario, the engineer of record (designer) and the construction contractor are two separate contracting entities. A schematic timeline illustrating this process is shown in Figure 5.1. For the purpose of this discussion, the timeline assumes aggressive durations and that construction funding would be available at the end of the design phase.

Figure 5.1 Process Schedule



5.8.2 Environmental Considerations

As part of the Environmental Permitting and Design phase, a complete assessment of impacts of the project on the natural and human environment is required. This includes conducting the assessment of impacts and potential avoidance or mitigation measures in a manner consistent with NEPA and MEPA, as well as other federal and state permitting and review requirements.

The following provides a summary of the environmental processes and issues that will need to be assessed in advancement of any bridge replacement.

ENVIRONMENTAL POLICY ACTS

The project proponent, in coordination with the Environmental Services section of the MassDOT Highway Division, will be responsible for identifying and complying with all applicable federal, state, and local environmental laws and requirements. This includes determining the appropriate project category for the NEPA and MEPA processes.

Environmental documentation and permitting is often completed in conjunction with the Preliminary Design phase. NEPA does not establish any quantitative thresholds for the environmental classification of a transportation improvement project. Transportation projects vary in type, size, complexity, and the potential to affect the environment. The impacts of such projects can vary from minor to significant impacts on the human environment. To account for the variability of project impacts, three basic "classes of action" are allowed and determine how compliance with NEPA is carried out and documented:

- An Environmental Impact Statement (EIS) is prepared for projects where it is known that the action will have a significant effect on the environment.
- An EA is prepared for actions in which the significance of the environmental impact is not clearly established. Should environmental analysis and interagency review during the EA process find a project to have no significant impacts on the quality of the environment, a Finding of No Significant Impact (FONSI) is issued.
- Categorical Exclusions (CEs) are issued for actions that do not individually or cumulatively have a significant effect on the environment.

The MEPA process includes eleven review thresholds that identify categories for projects that are likely to cause damage to the environment. These review thresholds determine whether MEPA review is required. MEPA review is required when one or more review thresholds are met or exceeded, and the subject matter of at least one review threshold is within MEPA jurisdiction. A review threshold that is met or exceeded also specifies whether MEPA review shall consist of an Environmental Notification Form (ENF) with a mandatory Environmental Impact Report (EIR) or an ENF and other MEPA review as required by the Massachusetts Secretary of the Executive Office of Energy & Environmental Affairs (EEA).

The project could require preparation and filing of an ENF and an EIR if the EEA Secretary so requires. This will likely be required in this instance since the bridge contains over 2,000 square feet of base area. In addition, depending on the in-water work required related to the removal of the existing center pier and resulting navigational dredging, the ENF criteria may be triggered by dredging and/or disposal of material. Additionally, depending upon the status of the review of the bridge by the Massachusetts Historical Commission (MHC) conducted as a part of the NEPA review, an ENF may be triggered due to the historical status of the existing bridge.

For the New Bedford-Fairhaven Bridge project, the following are the MEPA review thresholds that may require an ENF or an EIR:

Wetlands, Waterways, and Tidelands.

- ***ENF Required***
  - *Dredging of 10,000 or more cubic yards (cy) of material.*
  - *Disposal of 10,000 or more cy of dredged material, unless at a designated in-water disposal site.*
  - *Construction, reconstruction or expansion of a pile-supported or bottom-anchored structure of 2,000 or more sf base area,*

Historical and Archaeological Resources.

- ***ENF Required*** *- Unless the Project is consistent with a Memorandum of Agreement with the MHC that has been the subject of public notice and comment:*
  - *Demolition of all or any exterior part of any Historic Structure listed in or located in any Historic District listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth.*

A preliminary review of several other MEPA thresholds categories indicates that many are not applicable to this project. These categories are Land, Endangered Species, Water, Wastewater, Transportation, Energy, Air, Solid and Hazardous Waste, Areas of Critical Environmental Concern, and Regulations.

Pursuant to NEPA and MEPA, an analysis of natural and community resources and the impacts to these resources that would occur from the recommended alternatives must be prepared. As part of these analyses, a FHWA-compliant noise analysis, a programmatic Section 4(f) evaluation in compliance with the U.S. Department of Transportation Act of 1966, and a mesoscale and/or microscale air quality analyses would be completed.

ENVIRONMENTAL REVIEWS/PERMITS

In addition to development of the environmental impact assessments conducted as part of the NEPA and MEPA processes, other environmental review processes will be required. The following consultations and assessments may be required as the project moves through the Environmental Permitting, Design, and Right-of-Way development stage:

- Consultation with the MHC in accordance with Section 106 of the National Historic Preservation Act.
- Consultation with the New Bedford and Fairhaven Historical Commissions regarding the potential for impacts to historic resources.
- Coordination with the Massachusetts Office of Coastal Zone Management (CZM) regarding the following:
  - Chapter 91 Waterways Authorization, and
  - Construction within the 100-year floodplain and the applicability of CZM's Coastal Hazard Policies.
- Coordination with the U.S. Environmental Protection Agency (EPA) and MassDEP regarding the disturbance of contaminated soils and sediments within New Bedford Harbor. This includes construction-related disturbance and the appropriate

measures that would be required to minimize and/or mitigate potential impacts to water quality and fish and shellfish habitats from contamination.
- Coordination with the National Oceanographic Atmospheric Administration's National Marine Fisheries Service regarding the presence of essential fish habitats within New Bedford Harbor.

5.8.3 Alternative Refinement Considerations

In addition to the alternatives recommended for advancement, a number of other issues evolved or have been brought up by various stakeholders during the planning process for this study. As part of future project development process or other planning efforts, the following critical issues warrant further consideration:

- Coordination with U. S. Army Corps of Engineers on future plans for hurricane barrier.
- Coordination with FEMA and other local, state, and federal agencies to incorporate hazard mitigation and resiliency plans into capital improvement projects. The majority of the bridge corridor is located within the flood hazard area and climate adaptation will need to be considered during the design of any significant future investments.
- Coordination with South Coast Rail project on pedestrian and bicycle access needs in the station area.
- Continuous work with abutters to determine any access benefits and/or impacts.
- Traffic impacts from other development in area that were not previously considered.
- Conduct additional analysis to analyze potential benefits and impacts of closing southbound Route 18 ramp to westbound Route 6.

5.8.4 Implementation Summary

To assist in the completion of the recommended short-, medium-, and long-term recommendations, an implementation summary table was prepared to outline the future actions that various agencies or organizations would need to take. Table 5.4 outlines the recommended studies, actions, or projects. The timeframe, lead agency responsible for implementation, and coordinating agencies are also described. The short-, medium-, and long-term recommendations are shown on Figure 5.2.

Table 5.4. Recommendations Implementation Summary Table

Study/ Action/ Project	Description	Timeframe	Lead Agency	Coordinating Agencies
Long-Term Recommendations				
Advance Project into Project Initiation	Completion of Project Initiation Form (PIF) and review by Project Review Committee.	Short-term	MassDOT	SMMPO, Project Review Committee

Study/ Action/ Project	Description	Timeframe	Lead Agency	Coordinating Agencies
Evaluate projects for inclusion on MPO's RTP/TIP	Evaluation and prioritization of study recommendations as part of the RTP update and TIP.	Short-term	SMMPO	Municipalities, MassDOT
Advance Project into Environmental Permitting, Design and Right-of-Way Process	Following PIF review and inclusion into RTP and TIP, complete NEPA permitting and preliminary design phase.	Short- to Medium-term	MassDOT	SMMPO
Conduct Bridge Type Study	During preliminary design phase, study feasibility of vertical lift bridge or double-leaf Dutch-style bascule bridge.	Short- to Medium-term	MassDOT, design team	SMMPO, municipalities
Conduct U.S. Coast Guard Navigational Evaluation	During NEPA permitting process, detailed evaluation to determine ability of recommended bridge alternatives to meet navigational needs concerning horizontal and vertical clearances.	Short- to Medium-term	MassDOT, U.S. Coast Guard	Southeastern Massachusetts Metropolitan Planning Organization, municipalities
Short- & Medium-Term Recommendations				
Corridor intersection improvements	Implementation of improvements including changes to signal cycle length, timing splits or phasing, and coordination offset modifications at several corridor intersections.	Short-term	MassDOT	Municipalities
Bicycle and pedestrian path along Route 6 from Pleasant Street to Route 18	Design and construction of new 10- to 12-foot-wide multi-use path in existing ROW.	Short- to Medium-term dependent on funding availability.	MassDOT	SMMPO, municipalities
New pedestrian ramp and staircase between Route 6 and MacArthur Drive	Design and construction of new ADA-compliant pedestrian ramp and staircase in existing ROW.	Short- to Medium-term dependent on funding availability.	MassDOT	City of New Bedford
Completion of sidewalk network along MacArthur Drive	Design and construction of 85-foot-long sidewalk. May require easement or property acquisition.	Short- to Medium-term dependent on funding availability.	City of New Bedford	-
Variable message/ITS signage	Evaluation of options, design, and construction of new and replacement variable message/ITS signage in existing and additional locations.	Short- to Medium-term	MassDOT	-
Evaluate signage and pavement markings	Evaluate signage and pavement markings to be installed after current construction project.	Short-term	MassDOT	-

Figure 5.2 Short-, Medium- & Long-term Recommendations

SHORT- & MEDIUM-TERM RECOMMENDATIONS

Replacement Variable Message/ITS Signage
S1: I-195 EB (inoperable)*
S2: Kempton Street EB at Pleasant Street
S3: Pleasant Street SB at Route 6
S4: Purchase Street NB at Route 6
S5: Route 18 SB (after Pleasant Street exit)
S6: JFK Highway NB at Union Street
S7: Huttleston Avenue/Main Street (SW corner)
S8: Huttleston Avenue/Main Street (NW corner)
S9: Huttleston Ave/Main Street (WB signal arm)

New Variable Message/ITS Signage
N1: Route 6 WB at Route 240*
N2: Route 240 NB at Route 6*
N3: I-195 WB*
N4: Huttleson Avenue WB at Adams Street
N5: Middle Street NB at Huttleson Avenue

Corridor Intersection Improvements
I-1: Mill Street/Cottage Street
I-2: Kempton Street/Cottage Street
I-3: Mill Street/County Street
I-4: Kempton Street/County Street
I-5: Mill Street/Kempton Street/Pleasant Street
I-6: Huttleston Avenue/Main Street
I-7: Huttleston Avenue/Middle Street
I-8: Huttleston Avenue/Adams Street

Bicycle/Pedestrian Improvements
P1: Bike/pedestrian path along Route 6 (Pleasant Street to Route 18)
P2: New bike/pedestrian ramp (Route 6 to MacArthur Drive)
P3: MacArthur Drive sidewalk connection

LONG-TERM RECOMMENDATION

Advance Alternatives through Project Initiation & Environmental Permitting, Design & ROW Process

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NEW BEDFORD-FAIRHAVEN BRIDGE
CORRIDOR STUDY

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NEW BEDFORD-FAIRHAVEN BRIDGE
CORRIDOR STUDY

Appendix A
Delay and Level of Service (LOS) Tables - Existing 2014

Appendix A-1: Detailed Delay and LOS Table for AM Peak Hour (7:30 AM - 8:30 AM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
1	Kempton St Brownell Ave/ Route 140	Kempton St	EBL	324	1.06	97.4	F	69.8	E	126.4	F
			EBT	257	0.42	39.2	D				
			EBR	52							
			WBL	70	0.24	29.2	C	15.5	B		
			WBT	308	0.57	45.5	D				
			WBR	850	0.70	2.8	A				
		Brownell Ave	NBL	28	1.26	183.1	F	183.1	F		
			NBT	327							
			NBR	30							
		SR140	SBL	468	9.92dl	374.1	F	248.2	F		
			SBT	397							
			SBR	385	0.31	0.5	A				
2	Kempton St & Cornell St	Kempton St	EBL	79	0.37	7.1	A	3.5	A	11.0	B
			EBT	676	0.29	3.1	A				
			WBT	1150	0.65	10.4	B	10.4	B		
			WBR	38							
		Cornell St	SBL	65	0.67	49.5	D	49.5	D		
			SBR	78							
3	Kempton St & Rockdale Ave	Kempton St	EBL	141	0.75	53.6	D	26.4	C	53.8	D
			EBT	224	0.64	42.7	D				
			EBR	364	0.30	6.7	A				
			WBL	10	0.40	38.1	D	38.1	D		
			WBT	107							
			WBR	7							
		Rockdale Ave	NBL	578	0.83	28.9	C	20.9	C		
			NBT	331	0.38	8.8	A				
			NBR	35							
			SBL	26	1.31	217.4	F	217.4	F		
			SBT	319							
			SBR	18							
4	Mill St & Rockdale Ave	Mill St	WBL	11	0.81	59.6	E	59.6	E	16.8	B
			WBT	129							
			WBR	25							
		Rockdale Ave	NBL	57	0.14	4.0	A	5.1	A		
			NBT	422	0.42	5.3	A				
			SBT	352	0.41	12.6	B	11.9	B		
			SBR	90	0.08	9.2	A				

Appendix A-1: Detailed Delay and LOS Table for AM Peak Hour (7:30 AM - 8:30 AM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
5	Mill St & Cottage St	Mill St	WBL	24							
			WBT	150	0.75	38.0	D	38.0	D		
			WBR	13							
		Cottage St	NBL	43	0.21	11.7	B	11.7	B	19.4	B
			NBT	93							
			SBT	144	0.19	6.2	A	6.2	A		
			SBR	4							
6	Kempton St & Cottage St	Kempton St	EBL	7	0.02	12.2	B				
			EBT	336	0.73	21.5	C	20.5	C		
			EBR	40	0.04	12.3	B				
		Cottage St	NBT	129	0.44	19.1	B	19.1	B	21.3	C
			NBR	100							
			SBL	59	0.52	25.3	C	25.3	C		
			SBT	109							
7	Mill St & County St	Mill St	WBL	68							
			WBT	101	0.80	44.1	D	44.1	D		
			WBR	27							
		County St	NBL	42	0.14	9.8	A	9.4	A	21.3	C
			NBT	251	0.26	9.3	A				
			SBT	375	0.57	17.6	B	17.6	B		
			SBR	35							
8	Kempton St & County St	Kempton St	EBL	30	0.25	34.4	C				
			EBT	179	0.67	40.0	D	39.5	D		
			EBR	123							
		County St	NBT	263	0.41	5.7	A	5.7	A	18.7	B
			NBR	166							
			SBL	62	0.48	13.7	B	13.7	B		
			SBT	381							
9	Kempton St/ Mill St & Purchase St	Kempton St	EBL	187	0.83	88.9	F				
			EBT	95	0.41	62.0	E	78.4	E		
			EBR	0	-	-	-				
		Mill St	WBL	354	0.92	96.0	F				
			WBT	120	0.95	102.1	F	92.6	F		
			WBR	104	0.43	60.0	E			75.3	E
		Purchase St	NBL	75	0.29	55.7	E				
			NBT	209	0.39	56.3	E	55.2	E		
			NBR	62	0.05	51.2	D				
			SBL	44							
			SBT	307	0.73	66.1	E	66.1	E		
			SBR	35							

Appendix A-1: Detailed Delay and LOS Table for AM Peak Hour (7:30 AM - 8:30 AM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
10	Huttleston Ave & Middle St	Huttleston Ave	EBT	295	0.26	6.3	A	6.3	A	9.0	A
			EBR	88							
			WBL	21	0.37	7.3	A	7.3	A		
			WBT	365							
		Middle St	NBL	98	0.37	27.2	C	27.2	C		
			NBR	20							
11	Huttleston Ave & Main St	Huttleston Ave	EBL	45	0.48	25.1	C	13.1	B	24.6	C
			EBT	252	0.29	10.8	B				
			EBR	18							
			WBL	18	0.28	27.7	C	24.2	C		
			WBT	278	0.47	24.0	C				
			WBR	67							
		Main St	NBL	49	0.63	32.5	C	32.5	C		
			NBT	53							
			NBR	12							
			SBL	72	0.77	39.5	D	39.5	D		
			SBT	55							
			SBR	59							
12	Huttleston Ave & Green St	Huttleston Ave	EBL	3	0.26	5.2	A	5.2	A	11.9	B
			EBT	311							
			EBR	34							
			WBL	5	0.22	11.9	B	11.9	B		
			WBT	294							
			WBR	12							
		Green St	NBL	36	0.46	35.7	D	35.7	D		
			NBT	7							
			NBR	10							
			SBL	12	0.37	37.3	D	37.3	D		
			SBT	3							
			SBR	5							

Appendix A-1: Detailed Delay and LOS Table for AM Peak Hour (7:30 AM - 8:30 AM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
13	Huttleston Ave & Adams St	Huttleston Ave	EBL	23	0.84	39.7	D	39.7	D	43.8	D
			EBT	275							
			EBR	35							
			WBL	5	0.58	32.4	C	32.4	C		
			WBT	248							
			WBR	103							
		Adams St	NBL	44	0.94	79.3	E	79.3	E		
			NBT	92							
			NBR	31							
			SBL	139	0.95	44.4	D	44.4	D		
			SBT	85							
			SBR	19							
14	Huttleston Ave & Holcomb St	Huttleston Ave	EBL	13	0.27	3.9	A	3.9	A	7.0	A
			EBT	398							
			EBR	34							
			WBL	24	0.22	3.7	A	3.7	A		
			WBT	315							
			WBR	1							
		Holcomb St	NBL	32	0.50	30.0	C	30.0	C		
			NBT	4							
			NBR	21							
			SBL	4	0.13	27.9	C	27.9	C		
			SBT	3							
			SBR	9							
15	Huttleston Ave & Bridge St	Bridge St	EBL	0	0.37	20.5	C	20.5	C	15.1	B
			EBT	87							
			EBR	43							
			WBL	29	0.71	27.8	C	27.8	C		
			WBT	119							
			WBR	99							
		Huttleston Ave	NBL	9	0.21	8.4	A	8.4	A		
			NBT	241							
			NBR	38							
			SBL	156	0.47	9.9	A	9.9	A		
			SBT	266							
			SBR	1							

Appendix A-1: Detailed Delay and LOS Table for AM Peak Hour (7:30 AM - 8:30 AM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
16	Huttleston Ave & Alden Rd	Huttleston Ave	EBL	124	0.60	38.1	D	22.3	C	29.2	C
			EBT	328	0.31	17.2	B				
			EBR	58							
			WBL	54	0.50	52.7	D	26.8	C		
			WBT	342	0.53	23.9	C				
			WBR	145							
		Alden Rd	NBL	45	0.47	39.1	D	39.1	D		
			NBT	70							
			NBR	17							
			SBL	172	0.73	39.8	D	39.8	D		
			SBT	104							
			SBR	58							
17	Huttleston Ave & Route 240	Huttleston Ave	EBL	51	0.21	17.6	B	15.2	B	20.1	C
			EBT	285	0.29	24.2	C				
			EBR	181	0.14	0.2	A				
		Route 6	WBL	48	0.16	14.5	B	12.7	B		
			WBT	279	0.33	20.5	C				
			WBR	240	0.17	0.3	A				
		SR 240	NBL	174	0.59	26.1	C	29.6	C		
			NBT	292	0.69	39.2	D				
			NBR	53	0.05	0.1	A				
			SBL	156	0.61	25.7	C	23.9	C		
			SBT	163	0.40	33.9	C				
			SBR	88	0.06	0.1	A				
18	Bridge St & Alden Rd	Bridge St	EBL	76	0.67	44.3	D	38.4	D	44.0	D
			EBT	229	0.78	36.7	D				
			EBR	25							
			WBL	92	0.58	35.8	D	24.6	C		
			WBT	228	0.70	29.6	C				
			WBR	131	0.15	10.3	B				
		Alden Rd	NBL	15	0.62	54.9	D	26.0	C		
			NBT	142	0.64	32.8	C				
			NBR	182	0.13	16.4	B				
			SBL	229	1.20	155.5	F	74.5	E		
			SBT	217	0.64	25.2	C				
			SBR	95	0.09	11.2	B				

Appendix A-1: Detailed Delay and LOS Table for AM Peak Hour (7:30 AM - 8:30 AM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
19	Bridge St Route 240	Bridge St	EBL	368	1.02	103.6	F	86.3	F	114.8	F
			EBT	238	0.95	79.8	E				
			EBR	34	0.04	28.0	C				
			WBL	14	0.20	51.3	D	51.4	D		
			WBT	46	0.49	54.1	D				
			WBR	128	0.10	50.5	D				
		Route 240	NBL	36	0.87	131.1	F	66.0	E		
			NBT	510	0.91	63.1	E				
			NBR	37	0.03	32.4	C				
			SBL	556	1.53	292.1	F	156.0	F		
			SBT	359	0.73	47.1	D				
			SBR	369	0.23	39.3	D				
20	Union St & Route 18	Union St	EBL	0	0.06	28.4	C	28.4	C	2.7	A
			EBR	1							
		Route 18	NBL	0	0.55	2.8	A	2.8	A		
			NBT	1255							
			SBT	1124	0.51	2.6	A	2.6	A		
			SBR	7							
21	Hillman St & Purchase St	Hillman St	WBL	80	0.51	39.3	D	39.3	D	31.4	C
			WBR	34							
		Purchase St	NBT	177	0.45	29.0	C	28.4	C		
			NBR	384	0.41	28.1	C				
			SBL	88	0.22	24.9	C	32.4	C		
			SBT	370	0.67	34.6	C				
22	Hillman St & NB JFK Memorial Hwy On Ramp	Hillman St	EBLT	-	-	-	-	-	-	-	-
			WBTR	-	-	-	-	-	-	-	-
23	Purchase St & SB JFK Memorial Hwy Off Ramp	JFK Memorial Hwy Off Ramp	WBL	340	-	53.3	F	53.3	F	25.9	D
			WBR	47							
		Purchase St	NBT	182	-	0.0	-	0.0	-		
			NBR	0							
			SBL	0	-	0.0	-	0.0	-		
			SBT	249							

Appendix A-1: Detailed Delay and LOS Table for AM Peak Hour (7:30 AM - 8:30 AM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
24	Linden St	Linden St	EBT	75	-	10.1	B	10.1	B		
	County St		EBR	154							
			WBL	25	-	9.2	A	9.2	A	10.8	B
			WBT	42							
		County St	NBL	174	-	11.7	B	11.7	B		
			NBR	104							
25	Washburn St & Belleville Ave	Washburn St	EBL	34							
			EBT	61	-	60.0	F	60.0	F		
			EBR	37							
			WBL	85	-	36.5	E	36.5	E		
			WBR	349						26.3	D
		Belleville Ave	NBT	50	-	0.0	0.0	0.0	0.0		
			NBR	5		.		.			
			SBL	265	-	6.4	A	6.4	A		
			SBT	114							
26	Coggeshall St	Coggeshall	EBL	17							
	& Mt. Pleasant	St	EBT	84	-	11.0	B	11.0	B		
			EBR	20							
			WBL	8							
			WBT	34	-	9.8	A	9.8	A		
			WBR	20						11.7	B
		Mt. Pleasant	NBL	16							
			NBT	196	-	13.0	B	13.0	B		
			NBR	24							
			SBL	10							
			SBT	141	-	11.3	B	11.3	B		
			SBR	17							
27	Coggeshall St	Coggeshall	EBL	5							
	& County St	St	EBT	114	0.26	11.1	B	11.1	B		
			EBR	13							
			WBL	42							
			WBT	59	0.25	11.0	B	11.0	B		
			WBR	8						12.2	B
		County St	NBL	10							
			NBT	203	0.46	13.2	B	13.2	B		
			NBR	50							
			SBL	14							
			SBT	176	0.36	12.2	B	12.2	B		
			SBR	6							

Appendix A-1: Detailed Delay and LOS Table for AM Peak Hour (7:30 AM - 8:30 AM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
28	Coggeshall St & Purchase St	Coggeshall St	EBL	6							
			EBT	137	0.20	4.8	A	4.8	A		
			EBR	35							
			WBL	36							
			WBT	94	0.25	5.1	A	5.1	A		
			WBR	62						170.0	F
		Purchase St	NBL	13							
			NBT	195	1.39	220.2	F	220.2	F		
			NBR	67							
			SBL	59							
			SBT	177	1.73	375.1	F	375.1	F		
			SBR	2							
29	Coggeshall St & Ashley Blvd	Coggeshall St	EBT	170	0.45	18.6	B	18.6	B		
			EBR	93							
			WBL	139	0.80	36.1	D	36.1	D		
			WBT	158						21.9	C
		Ashley Blvd	SBL	97	0.69	18.8	B				
			SBT	604				18.3	B		
			SBR	34	0.04	11.0	B				
30	Coggeshall St & Acushnet Ave	Coggeshall St	EBL	29	0.11	8.3	A	10.3	B		
			EBT	238	0.37	10.6	B				
			WBT	211	0.58	20.3	C	20.3	C		
			WBR	31						18.1	B
		Acushnet Ave	NBL	86	0.22	16.9	B	20.6	C		
			NBT	279	0.71	24.5	C				
			NBR	197	0.18	16.6	B				
31	Coggeshall St & N. Front St	Coggeshall St	EBL	59							
			EBT	315	-	1.8	A	1.8	A		
			EBR	61							
			WBL	92							
			WBT	228	-	2.9	A	2.9	A	7.3	A
			WBR	52							
		N. Front St	NBL	14							
			NBT	73	-	39.9	E	39.9	E		
			NBR	42							

Appendix A-1: Detailed Delay and LOS Table for AM Peak Hour (7:30 AM - 8:30 AM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
32	Coggeshall St & Belleville Ave	Coggeshall St	EBL	81	0.19	14.1	B				
			EBT	213	0.73	29.9	C	26.9	C		
			EBR	63							
			WBL	120	0.39	13.4	B				
			WBT	208	0.52	21.7	C	18.5	B		
			WBR	60	0.06	17.4	B			27.6	C
		Belleville Ave	NBL	31	0.46	23.1	C				
			NBT	131				21.7	C		
			NBR	271	0.24	20.9	C				
			SBL	128							
			SBT	196	0.88	40.8	D	40.8	D		
			SBR	133							
33	Coggeshall St & 195 Off Ramp	Coggeshall St	EBL	56	0.17	14.7	B				
			EBT	316	0.76	28.8	C	18.8	B		
			EBR	178	0.15	0.2	A				
			WBL	504	1.26	147.2	F				
			WBT	204	0.53	17.1	B	97.1	F		
			WBR	81						56.6	E
		195 Off Ramp	NBL	124	0.37	28.2	C				
			NBT	103	0.55	34.1	C	31.6	C		
			SBL	96	0.79	61.9	E	50.9	D		
			SBR	137	0.76	51.6	D				
34	Howland Rd & Main St	Howland Rd	EBL	30							
			EBT	140	0.79	49.0	D	49.0	D		
			EBR	109							
			WBL	8							
			WBT	232	0.40	4.9	A	4.9	A		
			WBR	1						50.8	D
		Main St	NBL	159							
			NBT	53	0.98	100.2	F	100.2	F		
			NBR	5							
			SBL	8							
			SBT	57	0.78	69.2	E	69.2	E		
			SBR	108							

Appendix A-1: Detailed Delay and LOS Table for AM Peak Hour (7:30 AM - 8:30 AM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
35	Howland Rd & Adams St	Howland Rd	EBL	0	0.20	0.4	A	0.4	A	41.4	D
			EBT	95							
			EBR	58							
			WBL	3	0.41	42.6	D	42.6	D		
			WBT	107							
			WBR	8							
		Adams St	NBL	130	0.86	69.9	E	69.9	E		
			NBT	85							
			NBR	2							
			SBL	5	0.52	50.1	D	50.1	D		
			SBT	55							
			SBR	4							
36	Howland Rd & Alden Rd	Howland Rd	EBL	14	-	17.9	C	17.9	C	4.2	A
			EBT	2							
			EBR	94							
		Nancy St	WBL	5	-	26.9	D	26.9	D		
			WBT	3							
			WBR	2							
		Alden Rd	NBL	57	-	2.7	0	2.7	0		
			NBT	192							
			NBR	1							
			SBL	3	-	0.2	0	0.2	0		
			SBT	402							
			SBR	22							

Appendix A-2: Detailed Delay and LOS Table for PM Peak Hour (4:00 PM - 5:00 PM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
1	Kempton St Brownell Ave/ Route 140	Kempton St	EBL	289	1.72	398.3	F	161.6	F	166.5	F
			EBT	513	0.78	48.3	D				
			EBR	77							
			WBL	87	0.75	68.7	E	23.8	C		
			WBT	455	0.61	43.6	D				
			WBR	635	0.47	1.1	A				
		Brownell Ave	NBL	25	1.15	143.7	F	143.7	F		
			NBT	308							
			NBR	40							
		SR140	SBL	475	9.53dl	463.0	F	288.1	F		
			SBT	445							
			SBR	529	0.38	0.7	A				
2	Kempton St & Cornell St	Kempton St	EBL	105	0.38	4.4	A	3.3	A	9.0	A
			EBT	923	0.36	3.2	A				
			WBT	1123	0.56	8.4	A	8.4	A		
			WBR	41							
		Cornell St	SBL	79	0.71	54.0	D	54.0	D		
			SBR	54							
3	Kempton St & Rockdale Ave	Kempton St	EBL	214	0.61	30.7	C	23.0	C	56.8	E
			EBT	336	0.61	30.1	C				
			EBR	392	0.30	12.3	B				
			WBL	7	0.25	24.8	C	24.8	C		
			WBT	80							
			WBR	6							
		Rockdale Ave	NBL	507	1.23	145.9	F	90.6	F		
			NBT	320	0.50	19.2	B				
			NBR	72							
			SBL	32	0.95	74.4	E	74.4	E		
			SBT	358							
			SBR	19							
4	Mill St & Rockdale Ave	Mill St	WBL	21	0.56	36.2	D	36.2	D	16.8	B
			WBT	155							
			WBR	32							
		Rockdale Ave	NBL	61	0.17	5.7	A	7.6	A		
			NBT	479	0.49	7.9	A				
			SBT	388	0.50	19.6	B	18.2	B		
			SBR	105	0.13	14.2	B				

Appendix A-2: Detailed Delay and LOS Table for PM Peak Hour (4:00 PM - 5:00 PM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
5	Mill St & Cottage St	Mill St	WBL	21	0.77	27.9	C	27.9	C	16.5	B
			WBT	242							
			WBR	17							
		Cottage St	NBL	39	0.21	5.3	A	5.3	A		
			NBT	117							
			SBT	140	0.19	7.7	A	7.7	A		
			SBR	13							
6	Kempton St & Cottage St	Kempton St	EBL	24	0.07	11.5	B	18.2	B	14.4	B
			EBT	327	0.72	19.6	B				
			EBR	38	0.04	11.4	B				
		Cottage St	NBT	132	0.27	12.2	B	12.2	B		
			NBR	53							
			SBL	28	0.28	7.7	A	7.7	A		
			SBT	133							
7	Mill St & County St	Mill St	WBL	99	0.70	22.3	C	22.3	C	23.3	C
			WBT	197							
			WBR	30							
		County St	NBL	58	0.28	8.8	A	11.8	B		
			NBT	348	0.48	12.3	B				
			SBT	369	0.81	36.6	D	36.6	D		
			SBR	23							
8	Kempton St & County St	Kempton St	EBL	42	0.24	27.4	C	31.0	C	14.6	B
			EBT	244	0.65	31.5	C				
			EBR	104							
		County St	NBT	364	0.51	7.2	A	7.2	A		
			NBR	176							
			SBL	50	0.59	10.2	B	10.2	B		
			SBT	418							
9	Kempton St/ Mill St & Purchase St	Kempton St	EBL	276	1.02	123.8	F	101.5	F	82.2	F
			EBT	162	0.59	68.4	E				
			EBR	2	0.00	54.6	D				
		Mill St	WBL	352	0.96	105.7	F	91.4	F		
			WBT	161	0.89	90.9	F				
			WBR	94	0.46	60.9	E				
		Purchase St	NBL	147	0.54	62.4	E	60.3	E		
			NBT	404	0.64	62.1	E				
			NBR	134	0.15	52.8	D				
			SBL	44	0.94	85.6	F	85.6	F		
			SBT	457							
			SBR	60							

Appendix A-2: Detailed Delay and LOS Table for PM Peak Hour (4:00 PM - 5:00 PM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
10	Huttleston Ave & Middle St	Huttleston Ave	EBT	562	0.38	7.3	A	7.3	A	10.3	B
			EBR	109							
			WBL	11	0.34	7.8	A	7.8	A		
			WBT	465							
		Middle St	NBL	102	0.50	31.5	C	31.5	C		
			NBR	34							
11	Huttleston Ave & Main St	Huttleston Ave	EBL	120	0.46	12.1	B	11.3	B	28.6	C
			EBT	436	0.39	11.1	B				
			EBR	40							
			WBL	25	0.56	40.2	D	27.4	C		
			WBT	348	0.42	26.3	C				
			WBR	63							
		Main St	NBL	74	0.86	56.2	E	56.2	E		
			NBL	75							
			NBR	25							
			SBL	62	0.84	51.8	D	51.8	D		
			SBT	93							
			SBR	54							
12	Huttleston Ave & Green St	Huttleston Ave	EBL	4	0.33	6.3	A	6.3	A	15.3	B
			EBT	488							
			EBR	33							
			WBL	8	0.26	17.9	B	17.9	B		
			WBT	389							
			WBR	14							
		Green St	NBL	44	0.59	41.3	D	41.3	D		
			NBT	8							
			NBR	24							
			SBL	6	0.37	42.5	D	42.5	D		
			SBT	5							
			SBR	3							

Appendix A-2: Detailed Delay and LOS Table for PM Peak Hour (4:00 PM - 5:00 PM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
13	Huttleston Ave & Adams St	Huttleston Ave	EBL	23	1.00	65.8	E	65.8	E	51.8	D
			EBT	461							
			EBR	34							
			WBL	8	0.79	40.1	D	40.1	D		
			WBT	373							
			WBR	170							
		Adams St	NBL	30	0.95	92.9	F	92.9	F		
			NBT	84							
			NBR	29							
			SBL	122	0.72	19.4	B	19.4	B		
			SBT	72							
			SBR	8							
14	Huttleston Ave & Holcomb St	Huttleston Ave	EBL	31	0.35	4.0	A	4.0	A	7.1	A
			EBT	561							
			EBR	20							
			WBL	18	0.28	3.6	A	3.6	A		
			WBT	485							
			WBR	3							
		Holcomb St	NBL	29	0.48	30.6	C	30.6	C		
			NBT	9							
			NBR	23							
			SBL	13	0.27	29.4	C	29.4	C		
			SBT	7							
			SBR	37							
15	Huttleston Ave & Bridge St	Bridge St	EBL	8	0.24	19.4	B	19.4	B	17.8	B
			EBT	70							
			EBR	37							
			WBL	58	0.84	35.9	D	35.9	D		
			WBT	120							
			WBR	239							
		Huttleston Ave	NBL	14	0.32	9.4	A	9.4	A		
			NBT	341							
			NBR	85							
			SBL	200	0.59	11.5	B	11.5	B		
			SBT	400							
			SBR	3							

Appendix A-2: Detailed Delay and LOS Table for PM Peak Hour (4:00 PM - 5:00 PM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
16	Huttleston Ave & Alden Rd	Huttleston Ave	EBL	143	0.73	49.9	D	34.8	C	41.7	D
			EBT	459	0.63	31.0	C				
			EBR	85							
			WBL	97	0.68	54.1	D	46.7	D		
			WBT	396	0.82	45.6	D				
			WBR	180							
		Alden Rd	NBL	87	0.69	38.6	D	38.6	D		
			NBT	162							
			NBR	63							
			SBL	240	0.87	46.2	D	46.2	D		
			SBT	182							
			SBR	108							
17	Huttleston Ave & Route 240	Huttleston Ave	EBL	74	0.26	31.9	C	24.4	C	21.9	C
			EBT	425	0.45	39.3	D				
			EBR	263	0.21	0.2	A				
		Route 6	WBL	85	0.34	18.5	B	15.1	B		
			WBT	362	0.41	26.0	C				
			WBR	234	0.23	0.4	A				
		SR 240	NBL	192	0.61	27.2	C	28.5	C		
			NBT	251	0.68	39.2	D				
			NBR	94	0.07	0.1	A				
			SBL	260	0.64	19.9	B	21.1	C		
			SBT	352	0.52	30.1	C				
			SBR	122	0.09	0.1	A				
18	Bridge St & Alden Rd	Bridge St	EBL	178	0.99	97.3	F	67.8	E	51.8	D
			EBT	252	0.87	49.5	D				
			EBR	30							
			WBL	181	0.98	93.3	F	45.5	D		
			WBT	310	0.88	50.8	D				
			WBR	278	0.24	12.5	B				
		Alden Rd	NBL	39	1.01	145.7	F	59.6	E		
			NBT	251	0.95	72.5	E				
			NBR	195	0.16	16.7	B				
			SBL	205	0.98	89.0	F	42.3	D		
			SBT	319	0.72	30.4	C				
			SBR	164	0.14	11.1	B				

Appendix A-2: Detailed Delay and LOS Table for PM Peak Hour (4:00 PM - 5:00 PM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
19	Bridge St Route 240	Bridge St	EBL	448	0.94	69.7	E	61.0	E	51.4	D
			EBT	99	0.95	70.9	E				
			EBR	105	0.12	19.9	B				
			WBL	56	0.41	40.6	D	55.0	D		
			WBT	153	0.98	105.1	F				
			WBR	360	0.38	40.3	D				
		Route 240	NBL	89	1.03	149.7	F	57.8	E		
			NBT	445	0.83	44.3	D				
			NBR	25	0.03	22.2	C				
			SBL	107	0.71	50.4	D	41.2	D		
			SBT	573	0.89	48.8	D				
			SBR	527	0.37	32.1	C				
20	Union St & Route 18	Union St	EBL	0	0.26	60.2	E	60.2	E	2.4	A
			EBR	3							
		Route 18	NBL	0	0.52	2.1	A	2.1	A		
			NBT	1350							
			SBT	1449	0.56	2.4	A	2.4	A		
			SBR	0							
21	Hillman St & Purchase St	Hillman St	WBL	190	0.82	56.1	E	56.1	E	44.5	D
			WBR	54							
		Purchase St	NBT	281	0.56	31.1	C	38.7	D		
			NBR	539	0.79	42.6	D				
			SBL	99	0.25	25.3	C	47.5	D		
			SBT	415	0.91	53.5	D				
22	Hillman St & NB JFK Memorial Hwy On Ramp	Hillman St	EBLT	-	-	-	-	-	-	-	-
			WBTR	-	-	-	-	-	-	-	-
23	Purchase St & SB JFK Memorial Hwy Off Ramp	JFK Memorial Hwy Off Ramp	WBL	259	-	53.3	F	53.3	F	17.5	C
			WBR	53							
		Purchase St	NBT	316	-	0.0	-	0.0	-		
			NBR	0							
			SBL	0	-	0.0	-	0.0	-		
			SBT	314							

Appendix A-2: Detailed Delay and LOS Table for PM Peak Hour (4:00 PM - 5:00 PM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
24	Linden St County St	Linden St	EBT	67	-	12.5	B	12.5	B	14.3	B
			EBR	235							
			WBL	54	-	10.8	B	10.8	B		
			WBT	76							
		County St	NBL	204	-	16.8	C	16.8	C		
			NBR	133							
25	Washburn St & Belleville Ave	Washburn St	EBL	86	-	508.0	F	508.0	F	107.3	F
			EBT	96							
			EBR	10							
			WBL	35	-	16.4	C	16.4	C		
			WBR	572							
		Belleville Ave	NBT	4	-	0.0	-	0.0	-		
			NBR	7							
			SBL	288	-	6.0	A	6.0	A		
			SBT	129							
26	Coggeshall St & Mt. Pleasant	Coggeshall St	EBL	15	-	10.9	B	10.9	B	12.2	B
			EBT	68							
			EBR	14							
			WBL	18	-	10.3	B	10.3	B		
			WBT	59							
			WBR	17							
		Mt. Pleasant	NBL	31	-	13.4	B	13.4	B		
			NBT	208							
			NBR	29							
			SBL	14	-	12.4	B	12.4	B		
			SBT	227							
			SBR	7							
27	Coggeshall St & County St	Coggeshall St	EBL	9	0.21	10.6	B	10.6	B	13.1	B
			EBT	90							
			EBR	11							
			WBL	59	0.32	11.6	B	11.6	B		
			WBT	103							
			WBR	17							
		County St	NBL	20	0.51	13.4	B	13.4	B		
			NBT	246							
			NBR	41							
			SBL	15	0.57	14.6	B	14.6	B		
			SBT	275							
			SBR	15							

Appendix A-2: Detailed Delay and LOS Table for PM Peak Hour (4:00 PM - 5:00 PM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
28	Coggeshall St & Purchase St	Coggeshall St	EBL	6							
			EBT	130	0.29	16.4	B	16.4	B		
			EBR	10							
			WBL	33							
			WBT	151	0.57	21.1	C	21.1	C		
			WBR	71						14.7	B
		Purchase St	NBL	21							
			NBT	338	0.59	10.7	B	10.7	B		
			NBR	83							
			SBL	116							
			SBT	215	0.70	14.1	B	14.1	B		
			SBR	7							
29	Coggeshall St & Ashley Blvd	Coggeshall St	EBT	237	0.54	20.1	C	20.1	C		
			EBR	92							
			WBL	163	1.22	143.7	F	143.7	F		
			WBT	219						48.9	D
		Ashley Blvd	SBL	93	0.60	16.7	B				
			SBT	645				16.4	B		
			SBR	36	0.03	10.9	B				
30	Coggeshall St & Acushnet Ave	Coggeshall St	EBL	56	0.24	10.9	B	11.8	B		
			EBT	274	0.47	12.0	B				
			WBT	274	0.80	28.9	C	28.9	C		
			WBR	55						19.6	B
		Acushnet Ave	NBL	108	0.23	15.1	B	19.1	B		
			NBT	400	0.73	23.1	C				
			NBR	269	0.21	14.9	B				
31	Coggeshall St & N. Front St	Coggeshall St	EBL	68							
			EBT	427	-	2.3	A	2.3	A		
			EBR	48							
			WBL	66							
			WBT	298	-	3.1	A	3.1	A	58.2	F
			WBR	96							
		N. Front St	NBL	31							
			NBT	114	-	305.9	F	305.9	F		
			NBR	70							

Appendix A-2: Detailed Delay and LOS Table for PM Peak Hour (4:00 PM - 5:00 PM)

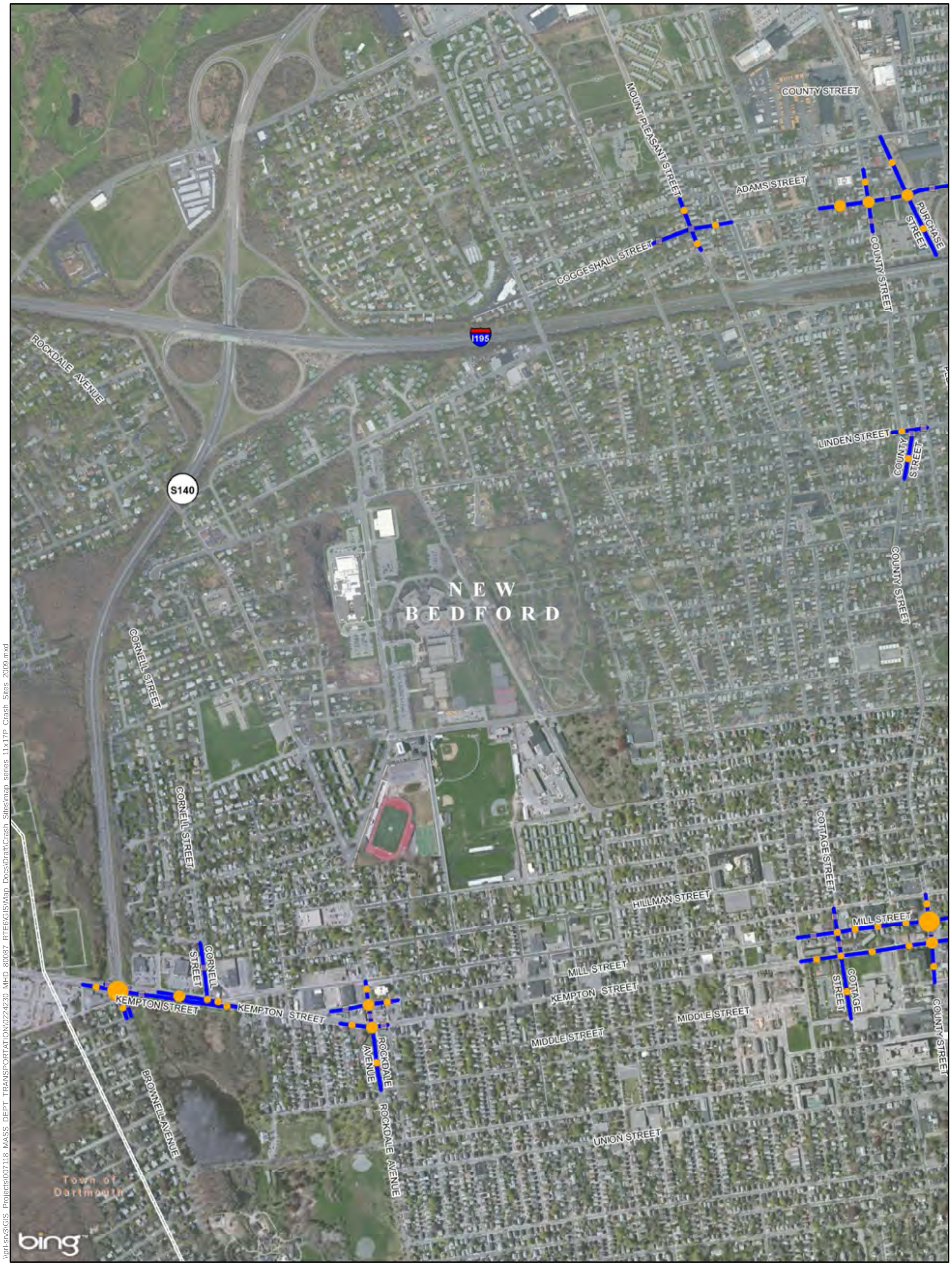
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
32	Coggeshall St & Belleville Ave	Coggeshall St	EBL	111	0.33	13.8	B	26.9	C	28.9	C
			EBT	339	0.76	31.4	C				
			EBR	47							
			WBL	171	0.69	20.8	C	23.2	C		
			WBT	304	0.65	26.6	C				
			WBR	93	0.10	19.3	B				
		Belleville Ave	NBL	39	0.77	34.8	C	27.1	C		
			NBT	174							
			NBR	449	0.48	23.4	C				
			SBL	169	0.88	40.3	D	40.3	D		
			SBT	199							
			SBR	116							
33	Coggeshall St & 195 Off Ramp	Coggeshall St	EBL	113	0.29	14.0	B	24.1	C	64.3	E
			EBT	465	0.75	29.5	C				
			EBR	249	0.28	19.8	B				
			WBL	290	1.05	77.1	E	47.9	D		
			WBT	191	0.60	21.0	C				
			WBR	157							
		195 Off Ramp	NBL	167	0.50	34.2	C	63.3	E		
			NBT	206	0.96	82.8	F				
			SBL	168	1.10	143.1	F	165.2	F		
			SBR	285	1.41	260.8	F				
34	Howland Rd & Main St	Howland Rd	EBL	43	1.23	169.2	F	169.2	F	124.7	F
			EBT	198							
			EBR	138							
			WBL	4	0.40	10.5	B	10.5	B		
			WBT	213							
			WBR	3							
		Main St	NBL	112	1.28	195.3	F	195.3	F		
			NBT	108							
			NBR	7							
			SBL	0	0.90	81.3	F	81.3	F		
			SBT	103							
			SBR	99							

Appendix A-2: Detailed Delay and LOS Table for PM Peak Hour (4:00 PM - 5:00 PM)

Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
35	Howland Rd & Adams St	Howland Rd	EBL	0	0.30	1.0	A	1.0	A	39.0	D
			EBT	133							
			EBR	72							
			WBL	7	0.87	78.5	E	78.5	E		
			WBT	133							
			WBR	9							
		Adams St	NBL	87	0.73	47.1	D	47.1	D		
			NBT	116							
			NBR	5							
			SBL	11	0.58	46.0	D	46.0	D		
			SBT	79							
			SBR	0							
36	Howland Rd & Alden Rd	Howland Rd	EBL	11	-	24.2	C	24.2	C	5.6	A
			EBT	0							
			EBR	131							
		Nancy St	WBL	4	-	43.4	E	43.4	E		
			WBT	1							
			WBR	5							
		Alden Rd	NBL	134	-	3.8	A	3.8	A		
			NBT	474							
			NBR	7							
			SBL	4	-	0.3	A	0.3	A		
			SBT	397							
			SBR	23							

NEW BEDFORD-FAIRHAVEN BRIDGE CORRIDOR STUDY

Appendix B
Vehicular Crash Maps, 2009-2011



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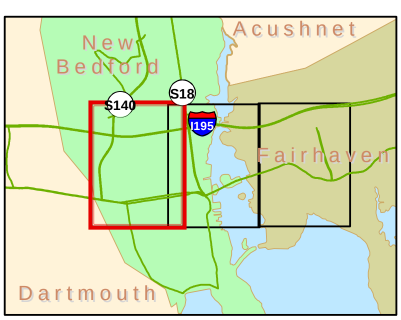

0 500 1,000
Feet

0 250 500
Meters

Study Intersections and Approaches

Number of Vehicular Crashes, 2009

1 - 4
5 - 8
9 - 16
17 - 24
Fatal Injuries
No Crash Recorded

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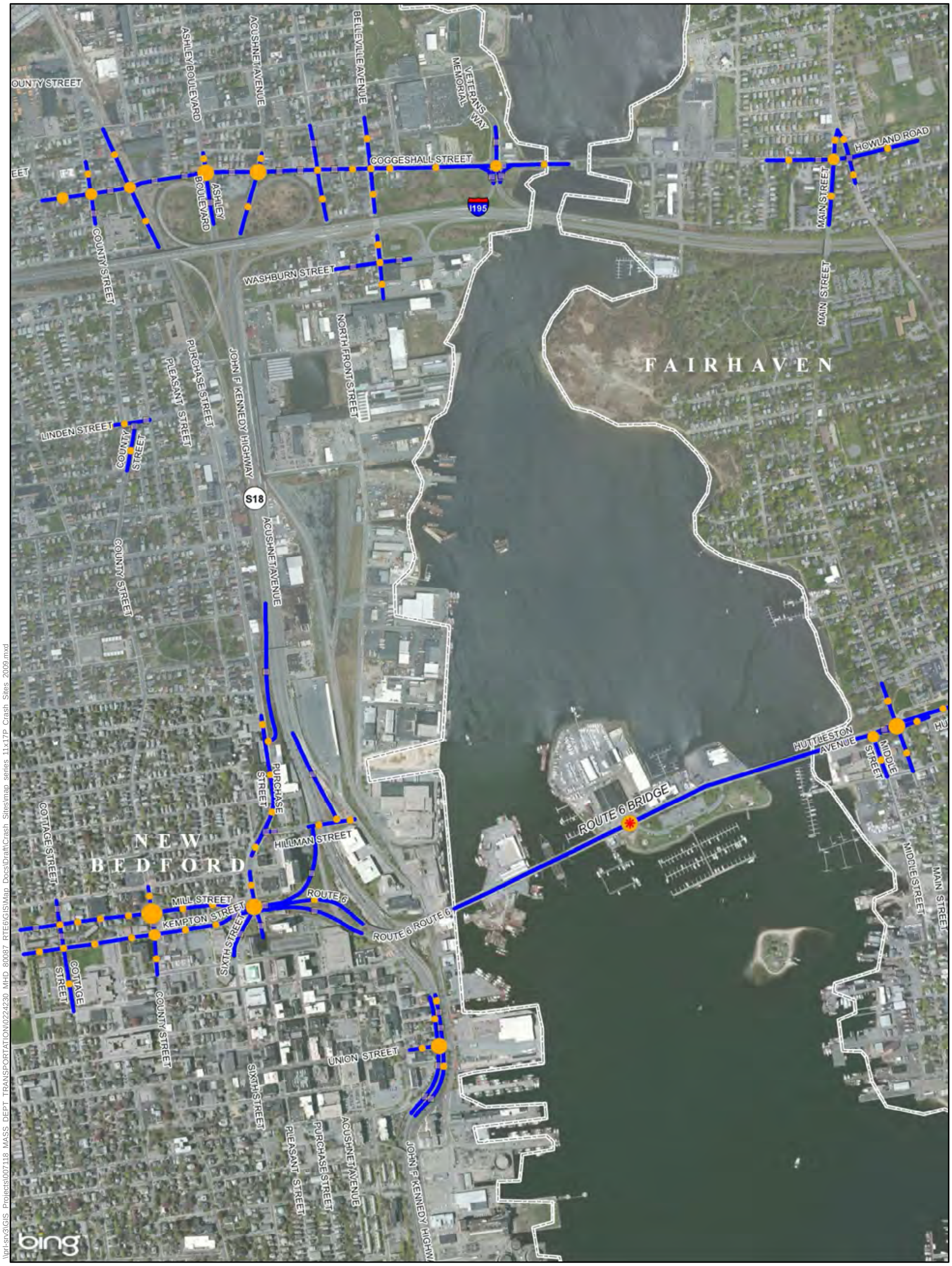

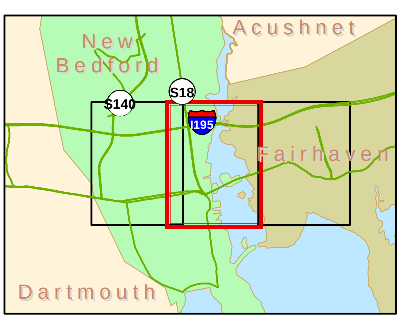

0 500 1,000
Feet

0 250 500
Meters

Study Intersections and Approaches

Number of Vehicular Crashes, 2009

- 1 - 4
- 5 - 8
- 9 - 16
- 17 - 24
- Fatal Injuries
- No Crash Recorded

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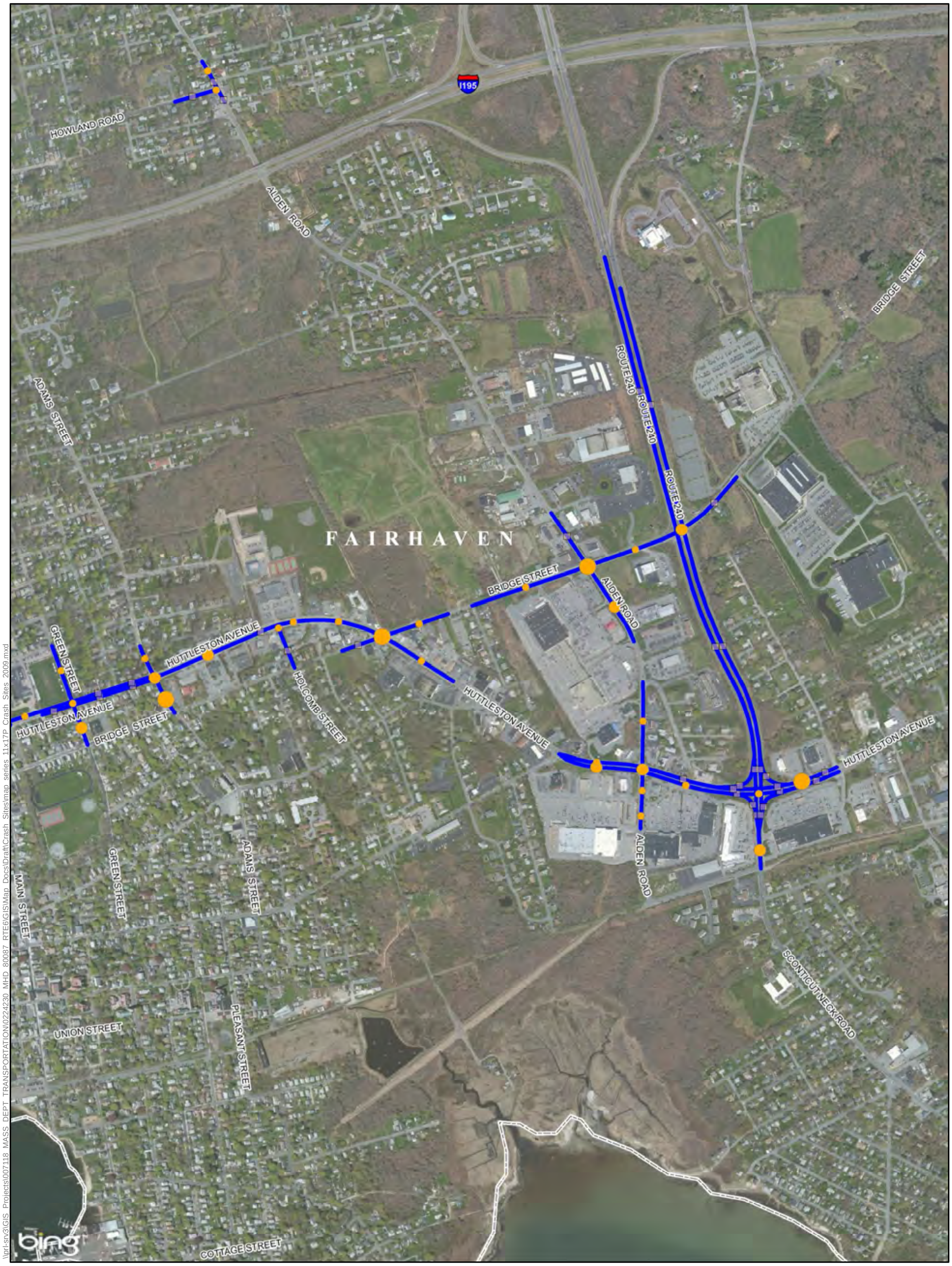

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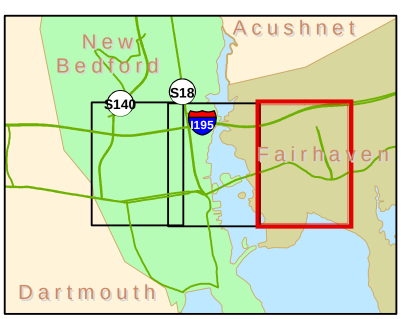

0 500 1,000
Feet

0 250 500
Meters

Study Intersections and Approaches

Number of Vehicular Crashes, 2009

1 - 4
5 - 8
9 - 16
17 - 24
Fatal Injuries
No Crash Recorded

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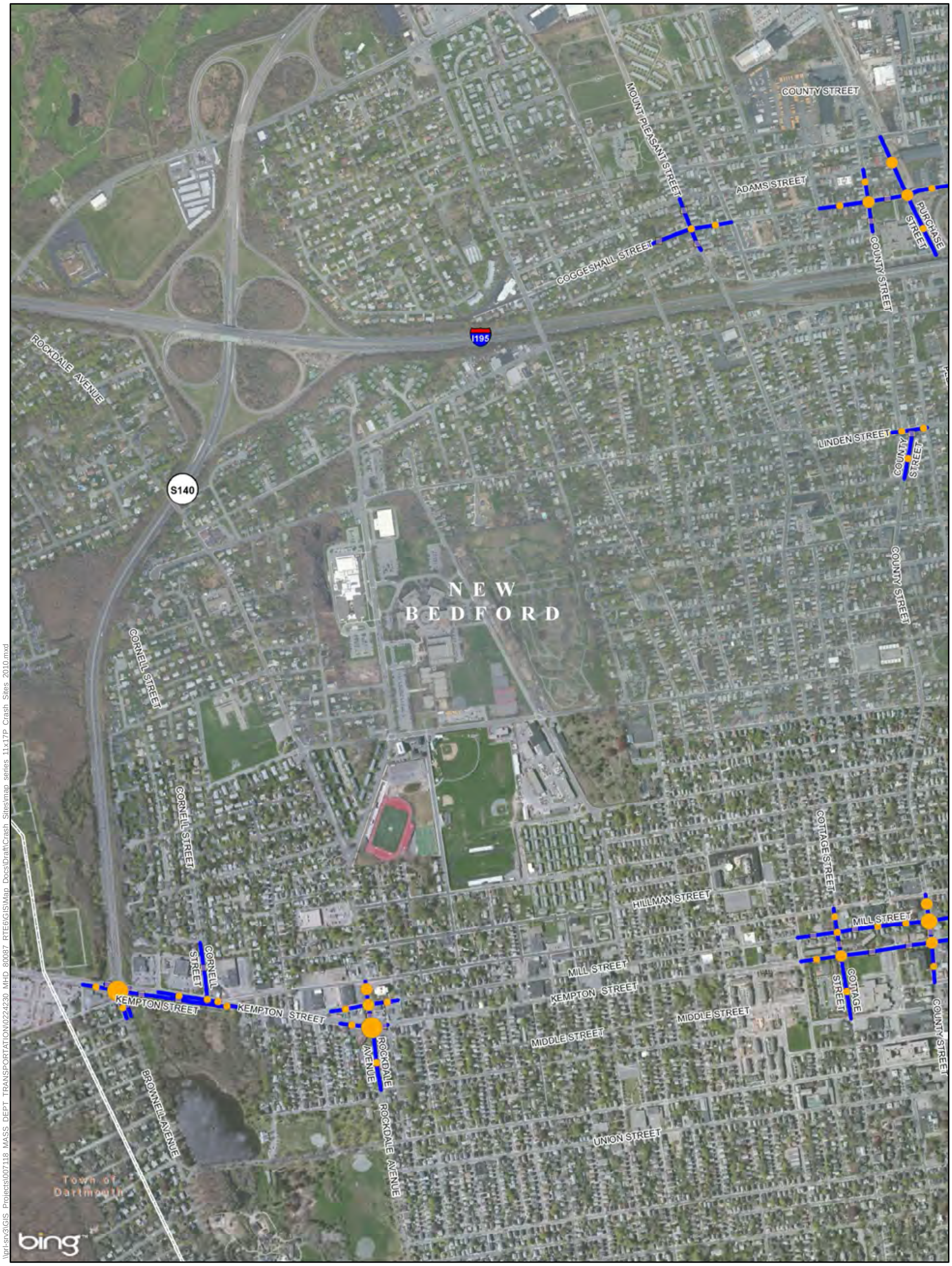
at Study Intersections, 2009
Thursday, May 08, 2014



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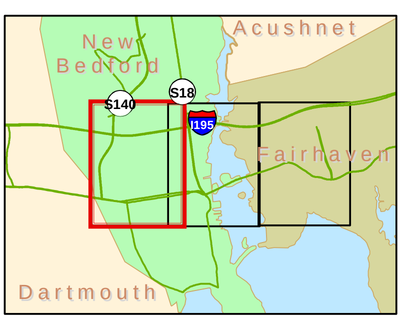

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Feet

0 250 500
Meters

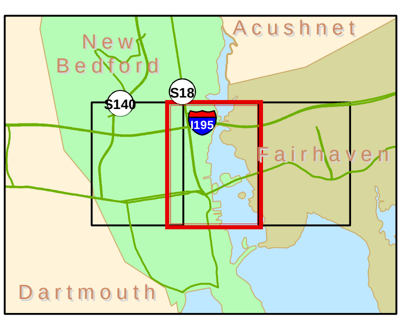
Study Intersections and Approaches

Number of Vehicular Crashes, 2010

1 - 4
9 - 16
5 - 8
17 - 24
Fatal Injuries
No Crash Recorded

Massachusetts Department of Transportation
Route 6 New Bedford/Fairhaven Bridge
Transportation Study

Page 1
Vehicular Crashes
at Study Intersections, 2010
Thursday, May 08, 2014



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0 250 500
Meters

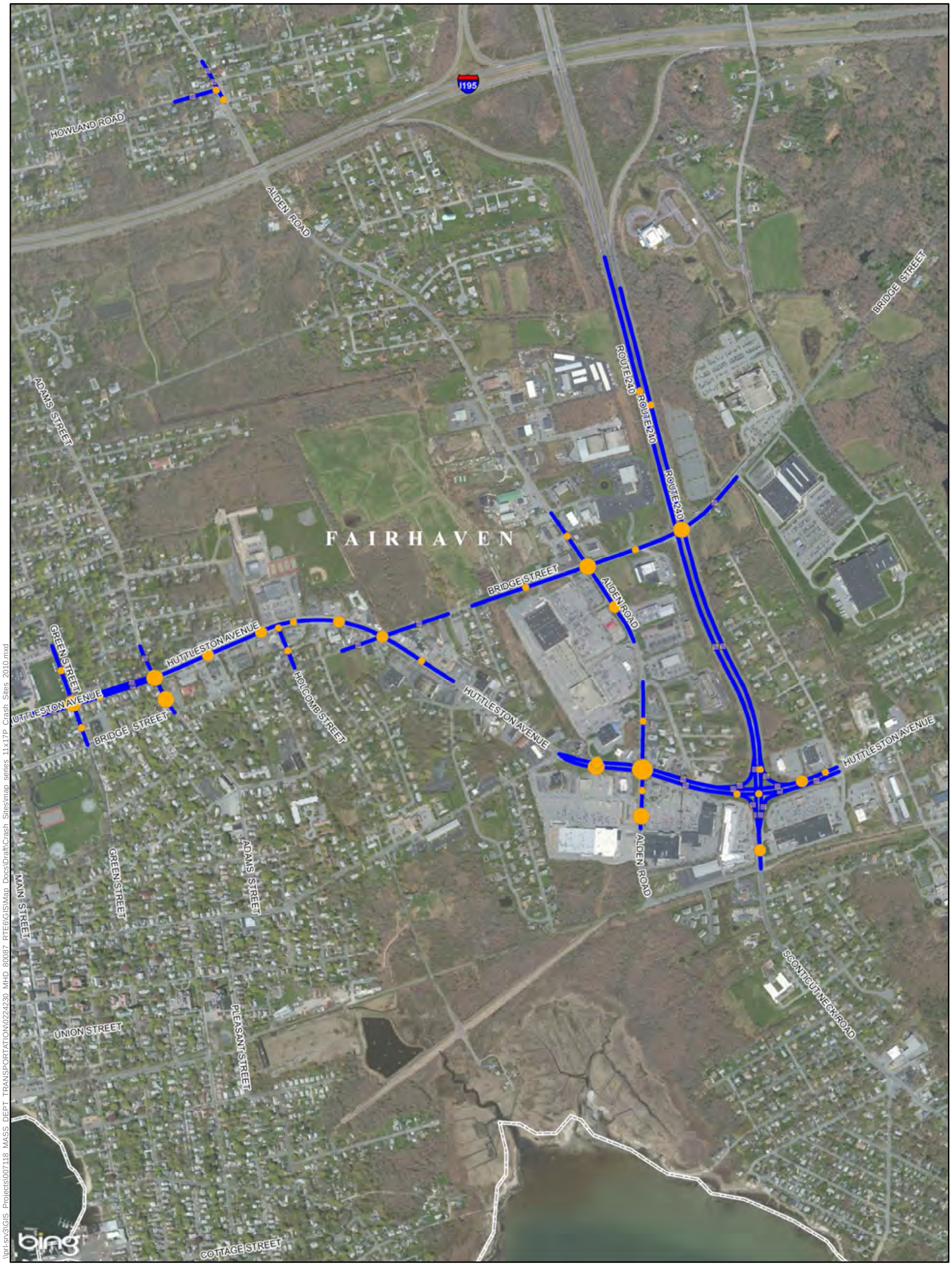
Study Intersections and Approaches

Number of Vehicular Crashes, 2010

- 1 - 4
- 5 - 8
- 9 - 16
- 17 - 24
- Fatal Injuries
- No Crash Recorded

Massachusetts Department of Transportation
Route 6 New Bedford/Fairhaven Bridge
Transportation Study

Page 2
Vehicular Crashes
at Study Intersections, 2010
Thursday, May 08, 2014



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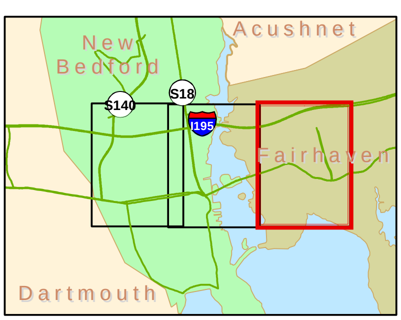

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Feet

0 250 500
Meters

Study Intersections and Approaches

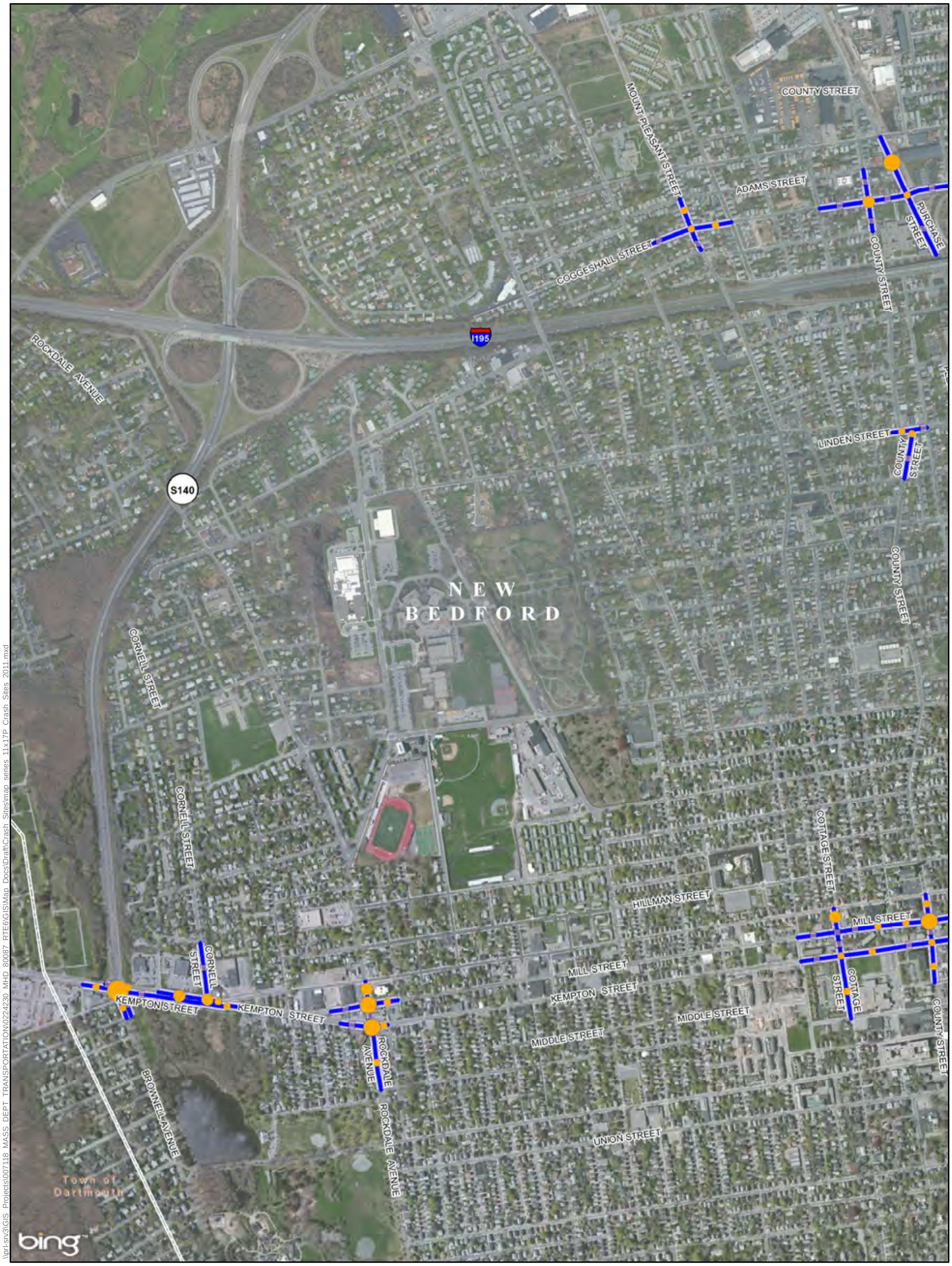
Number of Vehicular Crashes, 2010

1 - 4
5 - 8
9 - 16
17 - 24
Fatal Injuries
No Crash Recorded

HDR

Massachusetts Department of Transportation
Route 6 New Bedford/Fairhaven Bridge
Transportation Study

Page 3
Vehicular Crashes
at Study Intersections, 2010
Thursday, May 08, 2014



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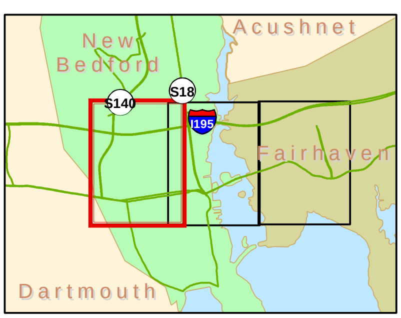


0 500 1,000
Feet

0 250 500
Meters

Study Intersections and Approaches

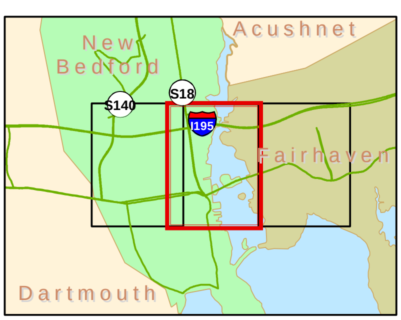
Number of Vehicular Crashes, 2011

1 - 4
5 - 8
9 - 16
17 - 24

No Crash Recorded
Fatal Injuries

Massachusetts Department of Transportation
Route 6 New Bedford/Fairhaven Bridge
Transportation Study

Page 1
Vehicular Crashes
at Study Intersections, 2011
Thursday, May 08, 2014



0 500 1,000
Feet

0 250 500
Meters

Study Intersections and Approaches

Number of Vehicular Crashes, 2011

- 1 - 4
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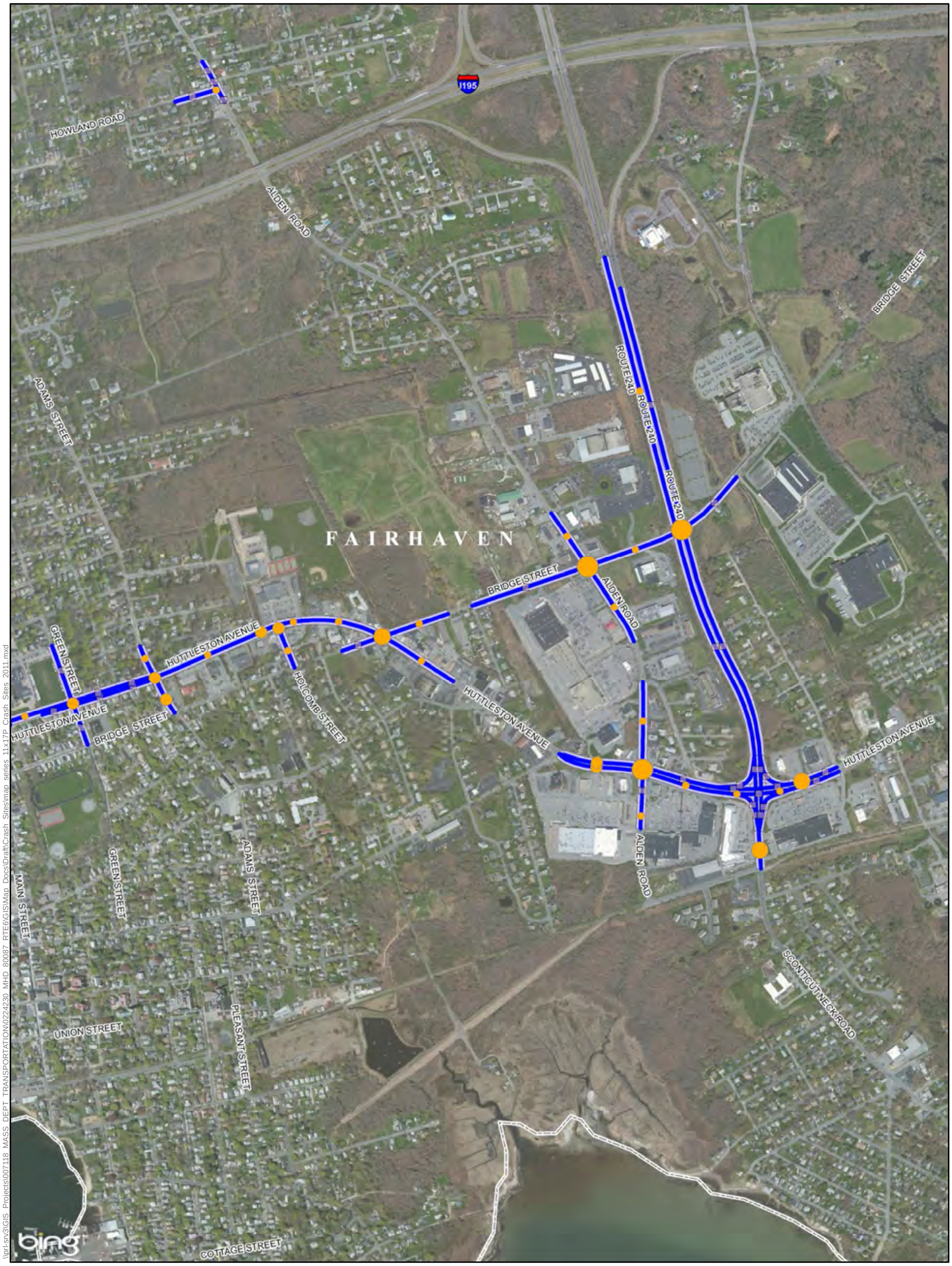
- Fatal Injuries

Massachusetts Department of Transportation
Route 6 New Bedford/Fairhaven Bridge
Transportation Study

Page 2
Vehicular Crashes
at Study Intersections, 2011
Thursday, May 08, 2014



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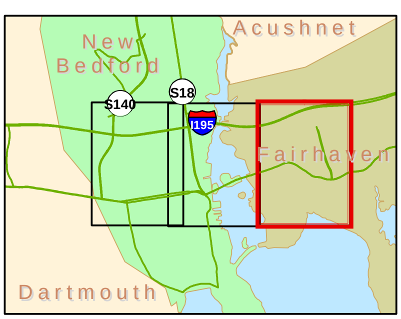

0 500 1,000
Feet

0 250 500
Meters

Study Intersections and Approaches

Number of Vehicular Crashes, 2011

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- 17 - 24
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- Fatal Injuries

Massachusetts Department of Transportation
Route 6 New Bedford/Fairhaven Bridge
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Vehicular Crashes
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Thursday, May 08, 2014

NEW BEDFORD-FAIRHAVEN BRIDGE
CORRIDOR STUDY

Appendix C
Traffic Volume Maps - Existing 2014

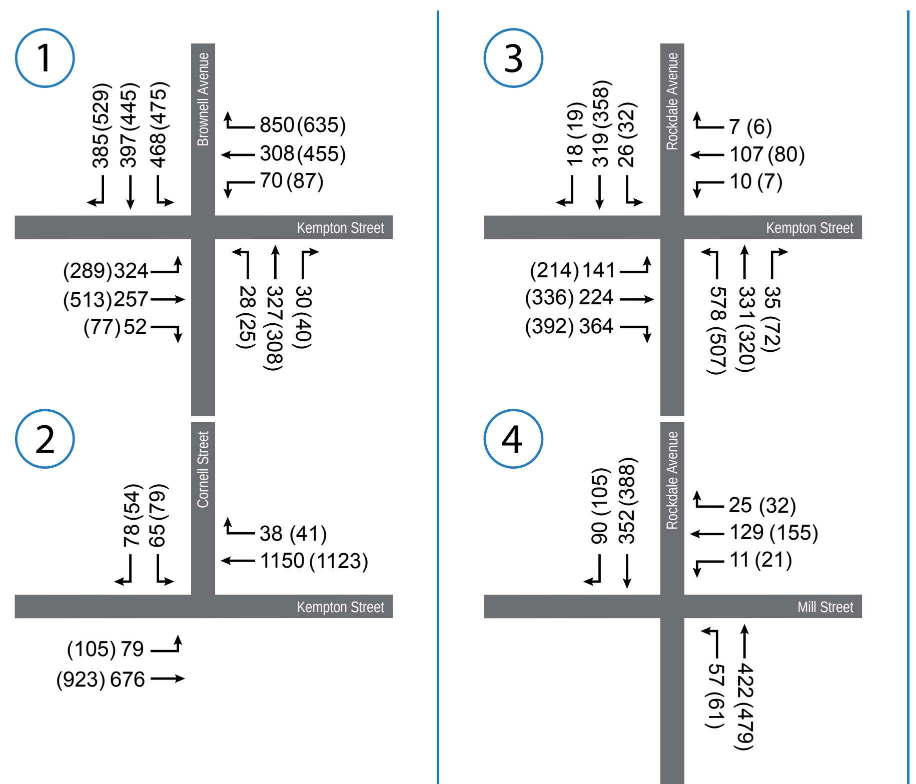
2014 Route 6 | New Bedford - Fairhaven Corridor Study

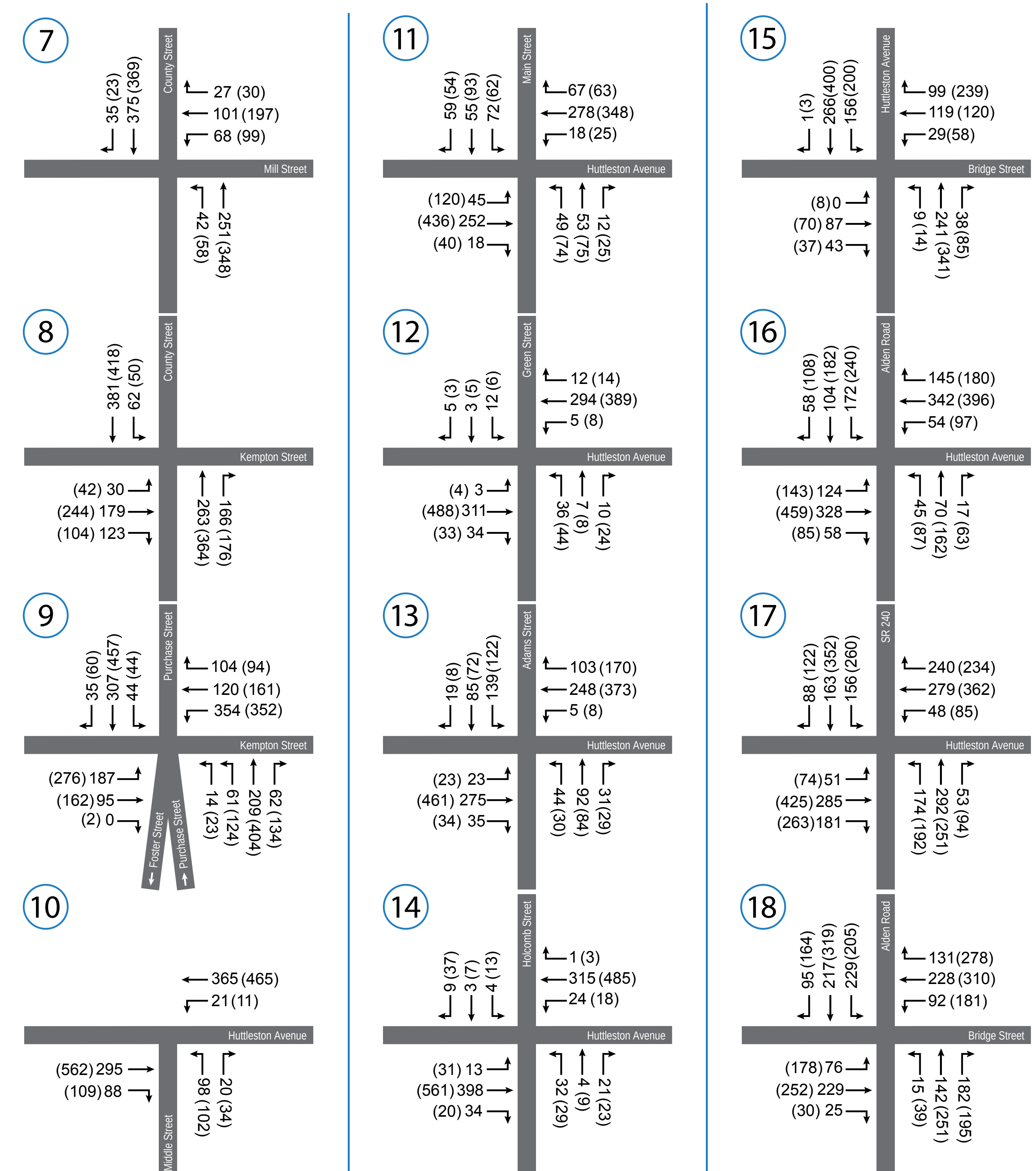
Existing AM (7:30-8:30AM) & PM (4:00-5:00 PM) Peak Volumes

massDOT Massachusetts Department of Transportation Office of Transportation Planning

HDR

Legend: (X) Location ID
000 AM Peak Hour Volume
(000) PM Peak Hour Volume





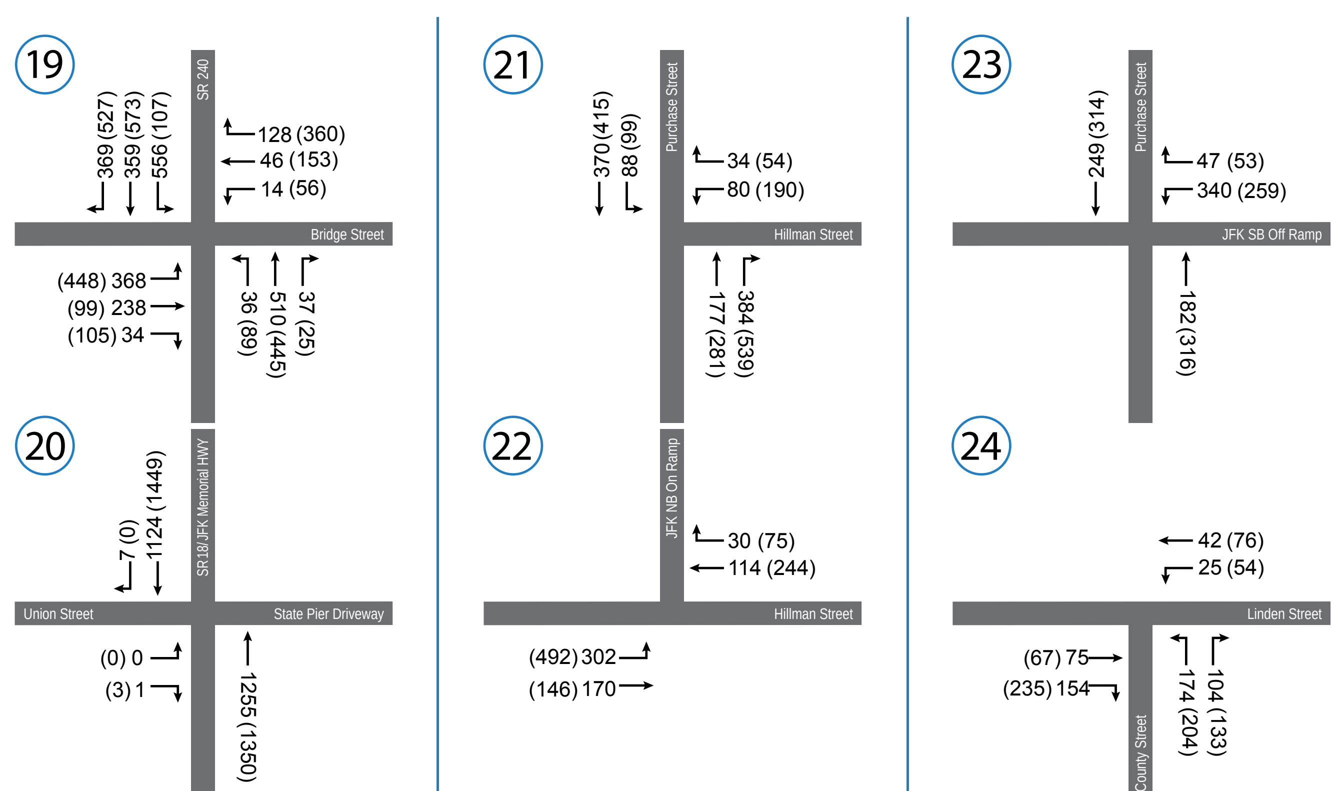
2014 Route 6 | New Bedford - Fairhaven Corridor Study

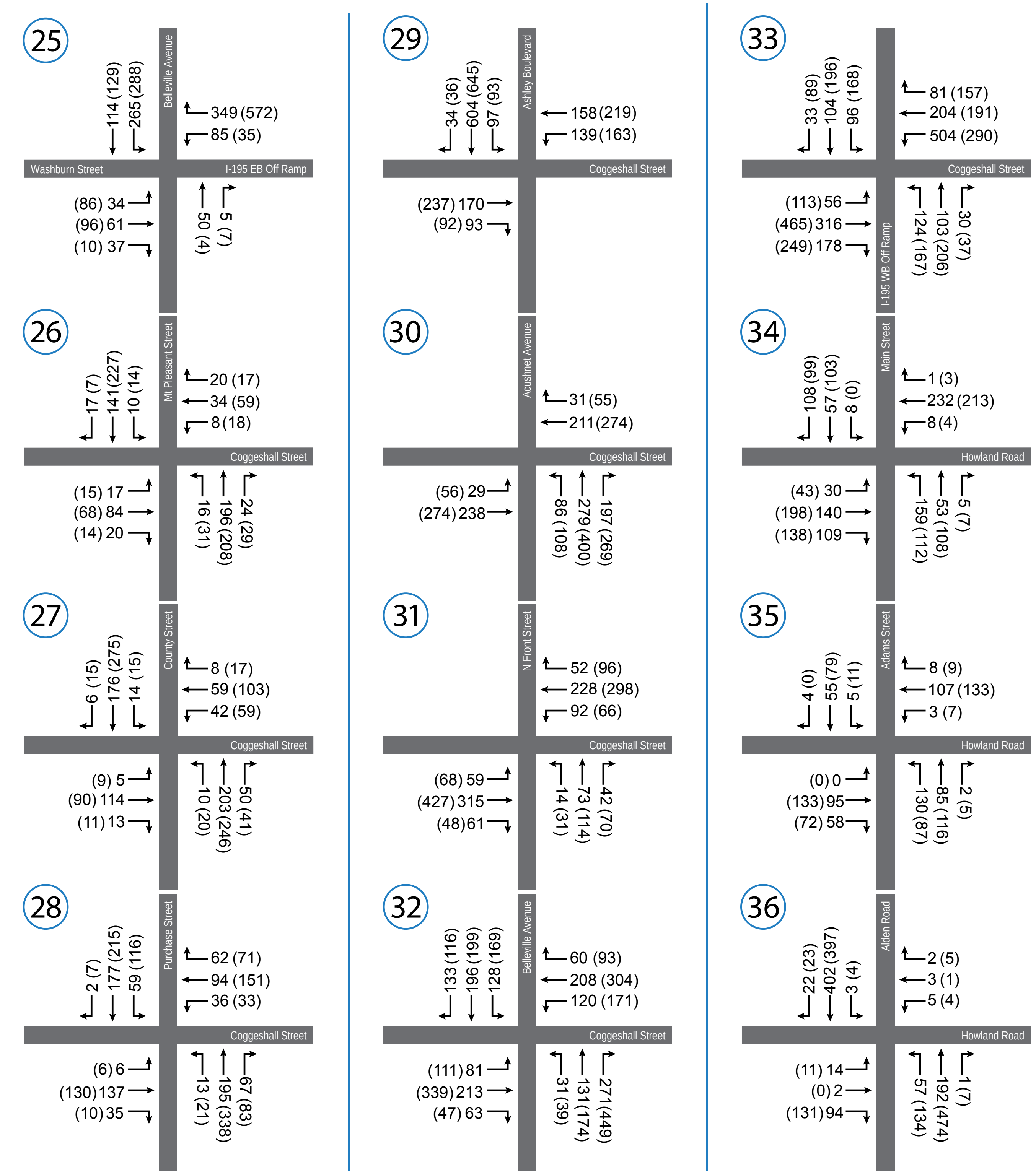
Existing AM (7:30-8:30AM) & PM (4:00-5:00 PM) Peak Volumes

massDOT
Massachusetts Department of Transportation
Office of Transportation Planning

HDR

Legend: (X) Location ID
000 AM Peak Hour Volume
(000) PM Peak Hour Volume



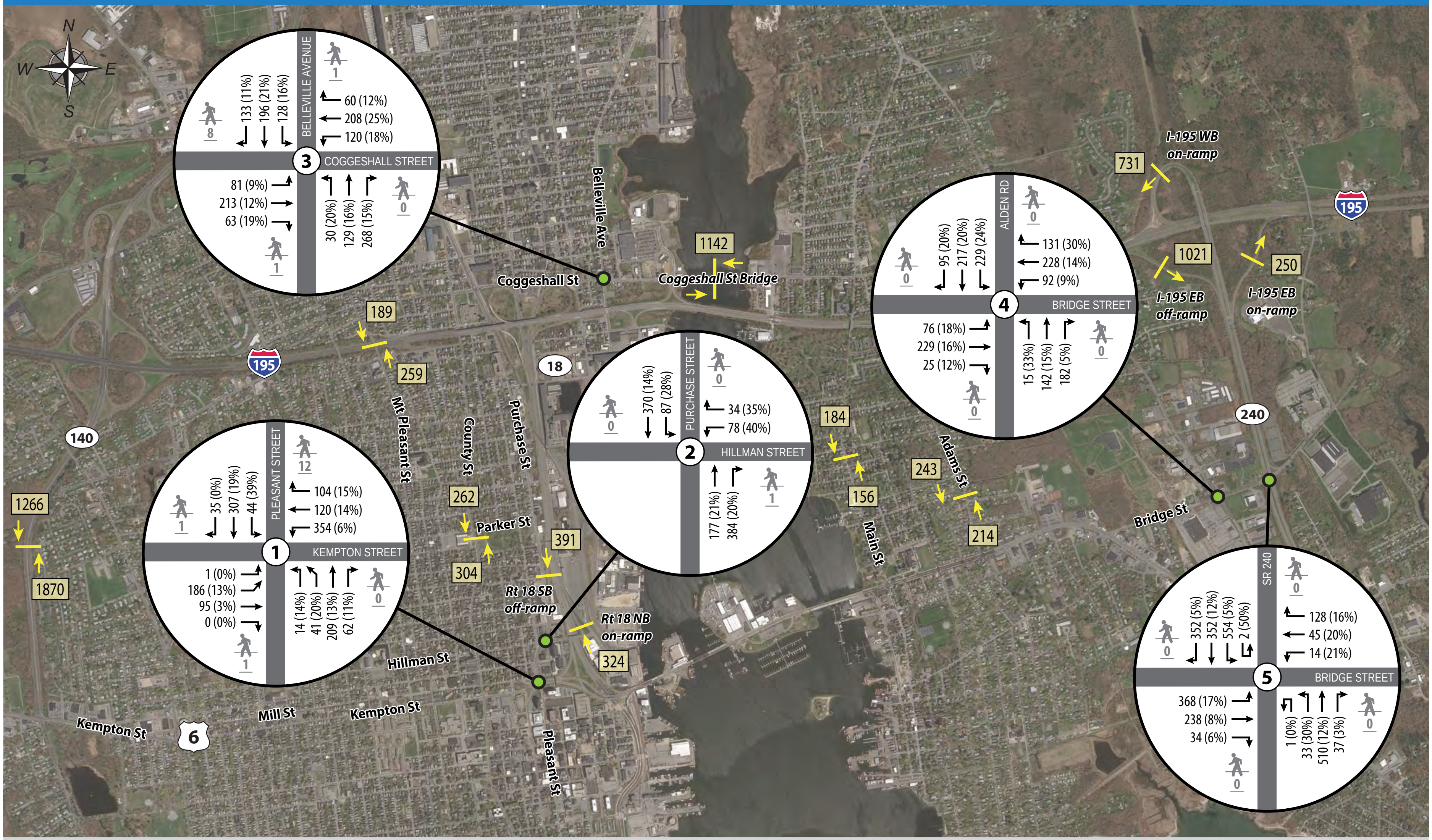


2014

Route 6 | New Bedford - Fairhaven Corridor Study

Existing Morning Peak Hour [7:30-8:30 am]

Vehicle and Pedestrian Volumes under Bridge Open Conditions in April 2014



LEGEND:

#	Study Intersection Location ID
000 (000)	AM Peak Hour Volumes (Heavy Vehicle %)
X	Pedestrians
XXX	Midblock Volume

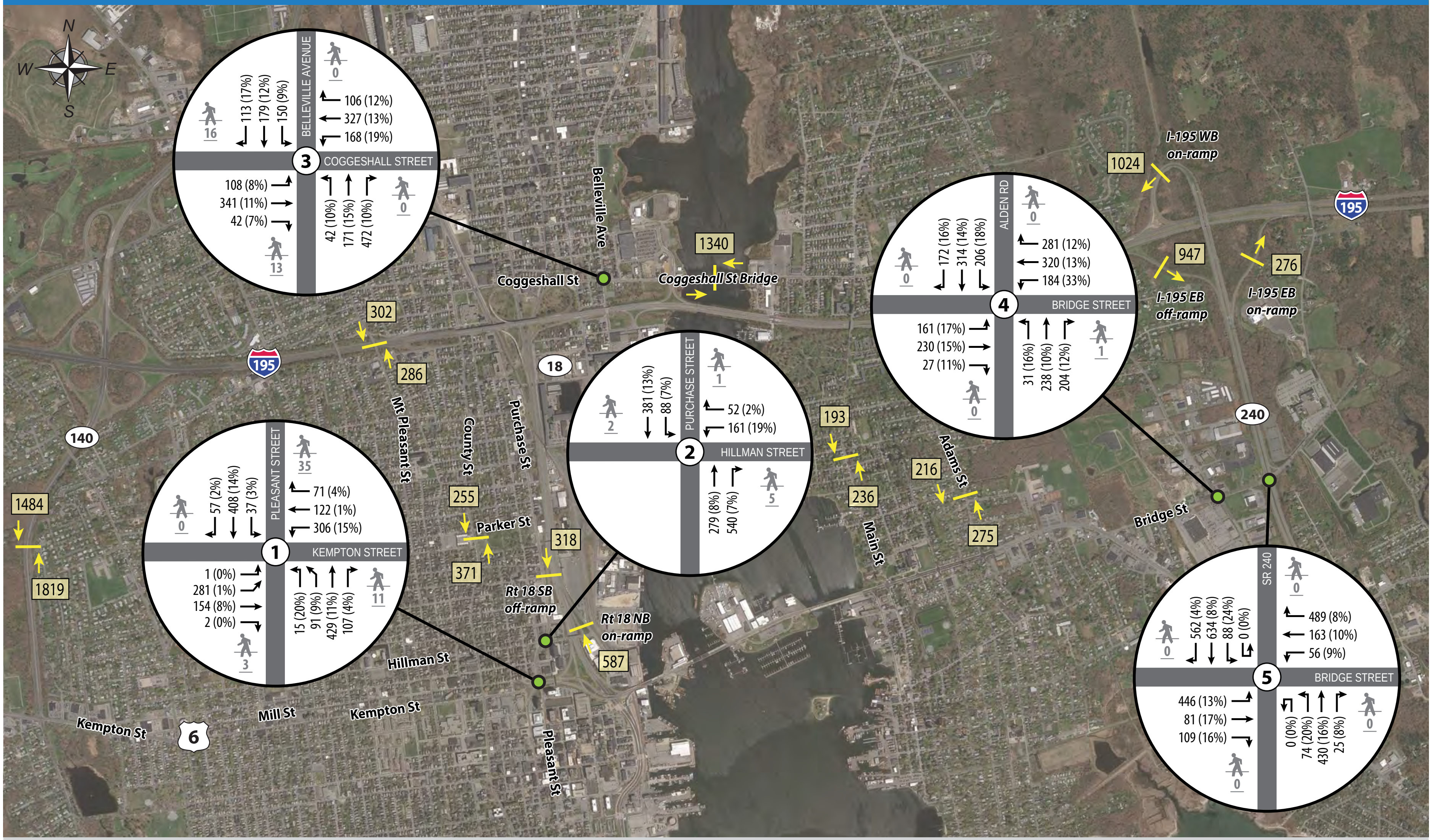
massDOT
Massachusetts Department of Transportation
Office of Transportation Planning

2014

Route 6 | New Bedford - Fairhaven Corridor Study

Existing Evening Peak Hour [4:30-5:30 pm]

Vehicle and Pedestrian Volumes under Bridge Open Conditions in April 2014



LEGEND:

#	Study Intersection Location ID	Pedestrians (X)	XXX Midblock Volume
000 (000)	PM Peak Hour Volumes (Heavy Vehicle %)		

massDOT
Massachusetts Department of Transportation
Office of Transportation Planning

2014

Route 6 | New Bedford - Fairhaven Corridor Study

Existing Morning Peak Hour [7:30-8:30 am]

Vehicle and Pedestrian Volumes during Bridge Closure in April 2014

LEGEND:

#	Study Intersection Location ID
000 (000)	AM Peak Hour Volumes (Heavy Vehicle %)

Pedestrians (X)

XXX Midblock Volume

massDOT
Massachusetts Department of Transportation
Office of Transportation Planning

2014 Route 6 | New Bedford - Fairhaven Corridor Study

Existing Evening Peak Hour [4:30-5:30 pm]

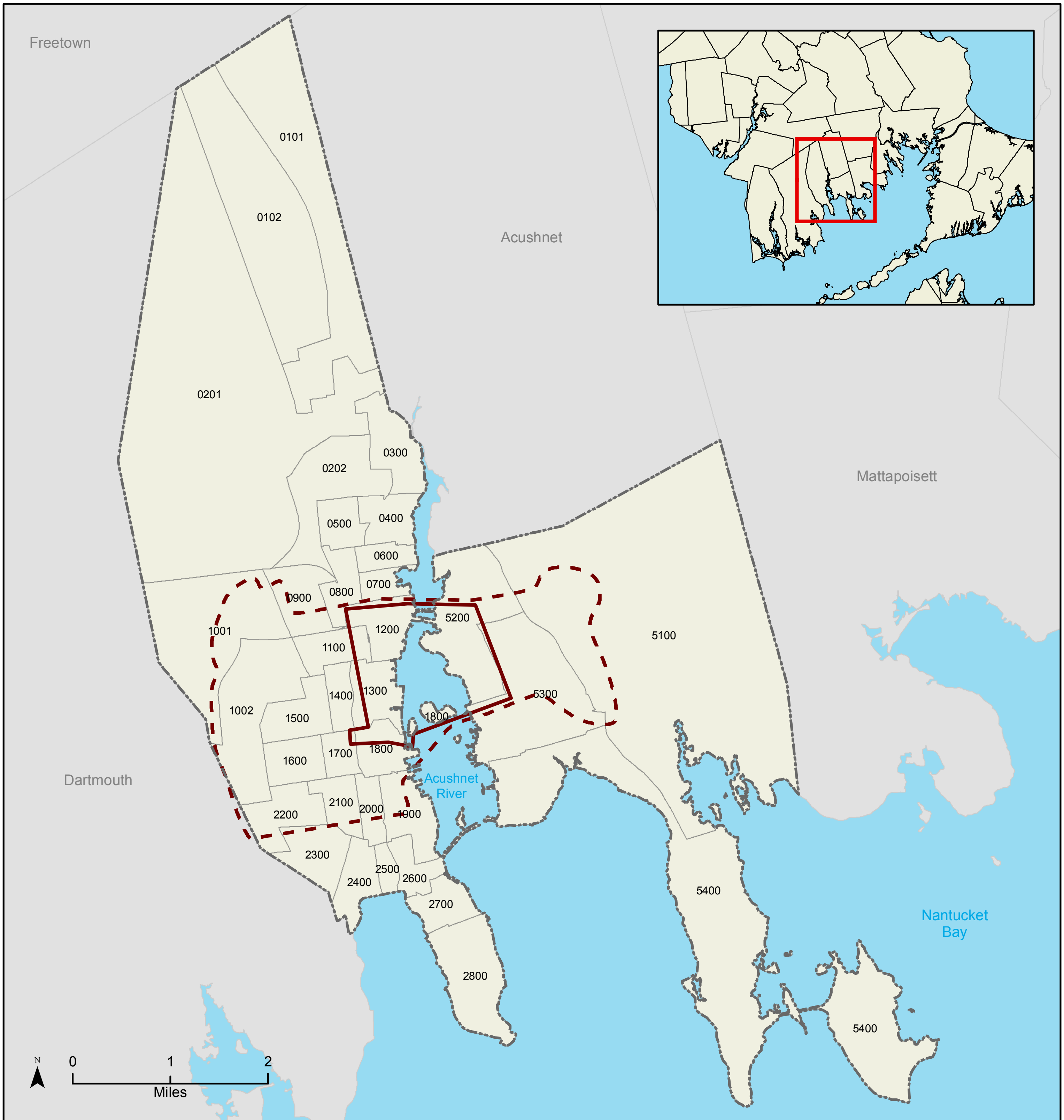
Vehicle and Pedestrian Volumes during Bridge Closure in April 2014

LEGEND:

#	Study Intersection Location ID
000 (000)	PM Peak Hour Volumes (Heavy Vehicle %)
X	Pedestrians
XXX	Midblock Volume

massDOT
Massachusetts Department of Transportation
Office of Transportation Planning

Appendix D
Environmental Justice Maps



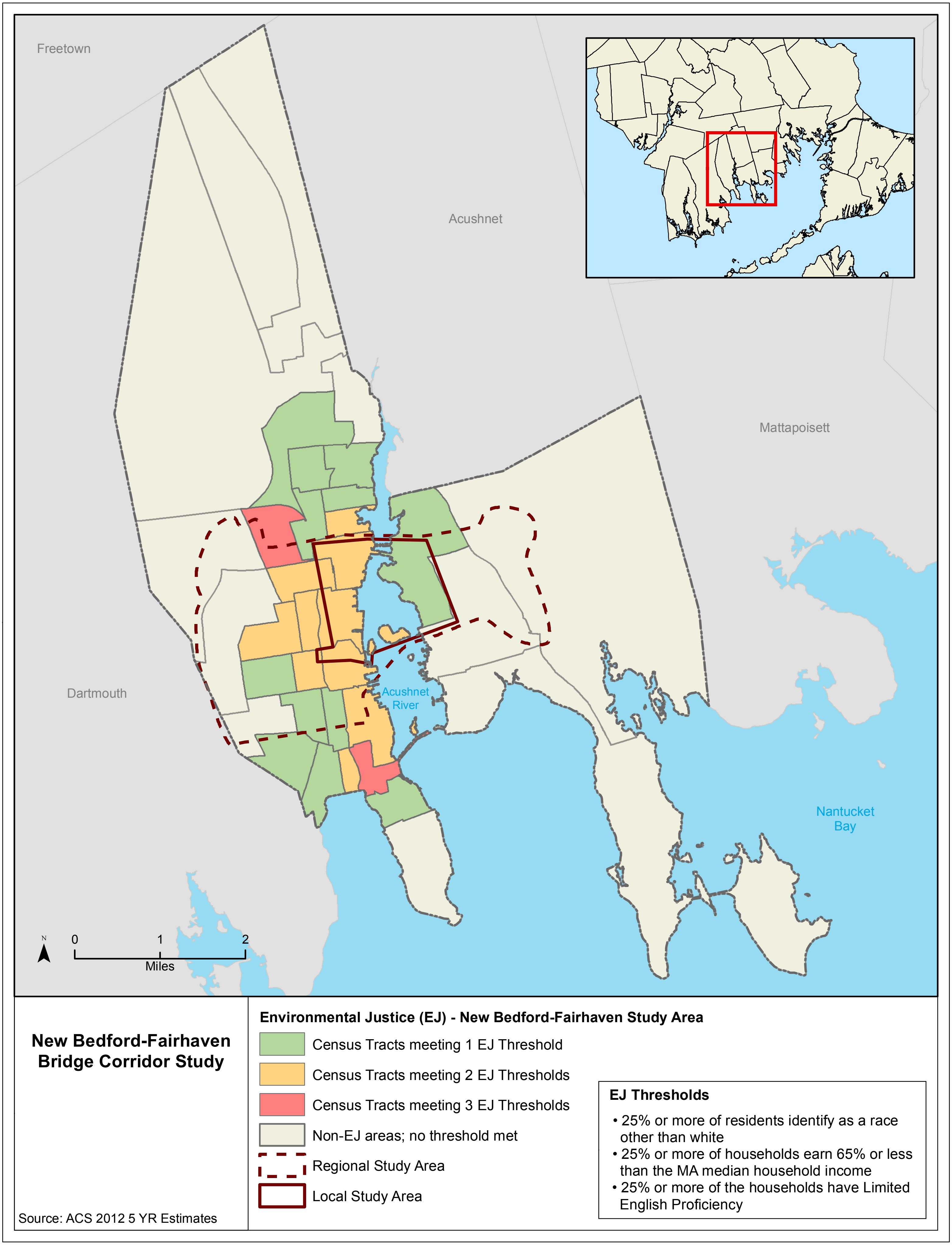
New Bedford-Fairhaven Bridge Corridor Study

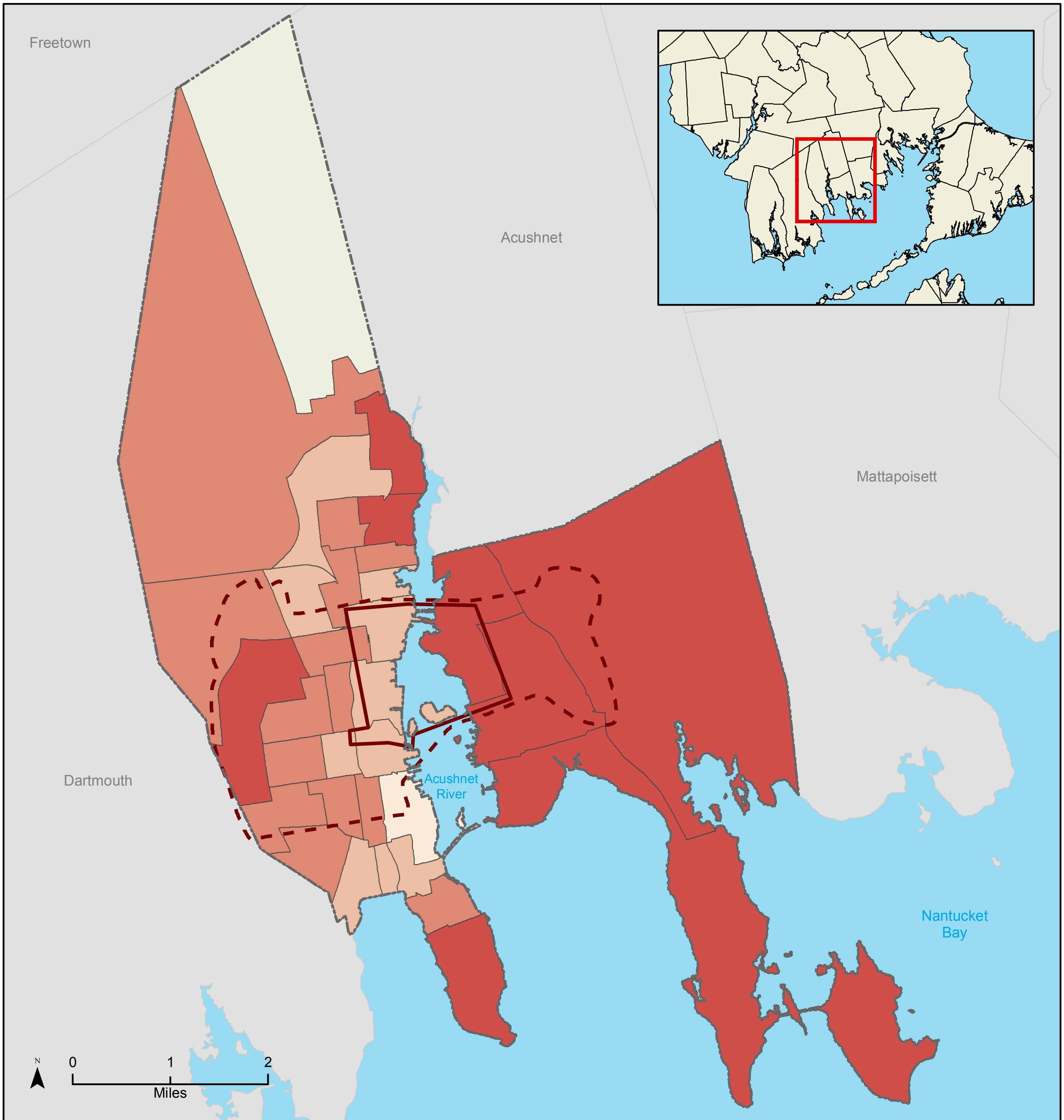
Census Tracts

Regional Study Area

Local Study Area

Source: ACS 2012 5 YR Estimates


Freetown
Acushnet
Mattapoisett
Dartmouth
Acushnet River
Nantucket Bay
0
1
2
Miles
N
New Bedford-Fairhaven Bridge Corridor Study
Environmental Justice (EJ) - New Bedford-Fairhaven Study Area
Census Tracts meeting 1 EJ Threshold
Census Tracts meeting 2 EJ Thresholds
Census Tracts meeting 3 EJ Thresholds
Non-EJ areas; no threshold met
Regional Study Area
Local Study Area
EJ Thresholds
• 25% or more of residents identify as a race other than white
• 25% or more of households earn 65% or less than the MA median household income
• 25% or more of the households have Limited English Proficiency
Source: ACS 2012 5 YR Estimates



New Bedford-Fairhaven Bridge Corridor Study

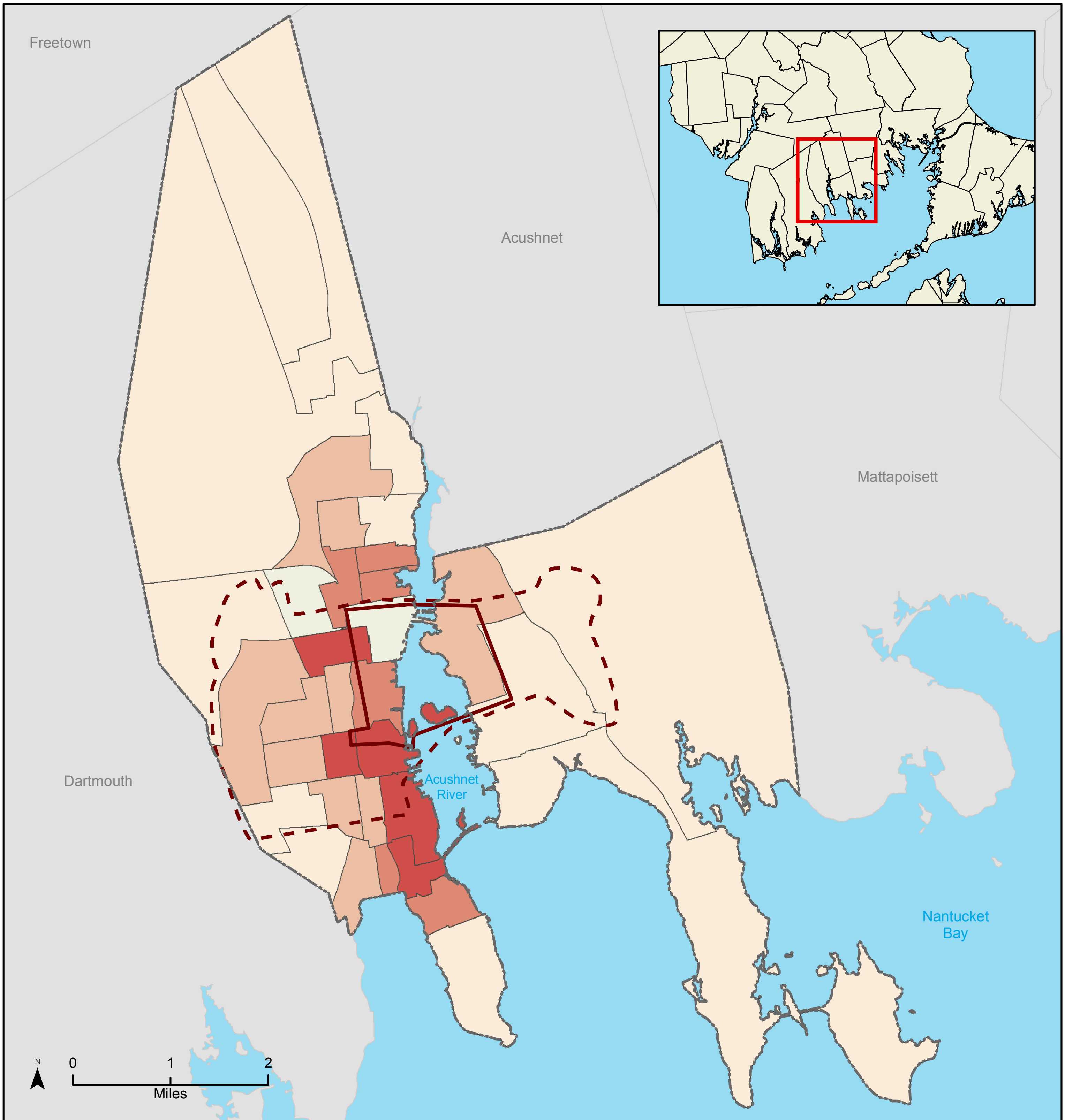
Total White Population by Census Tract

- 934 - 1,000
- 1,001 - 2,000
- 2,001 - 3,000
- 3,001 and greater

Regional Study Area

Local Study Area

Source: ACS 2012 5 YR Estimates



New Bedford-Fairhaven Bridge Corridor Study

Percent of Population Below Poverty Level by Census Tract

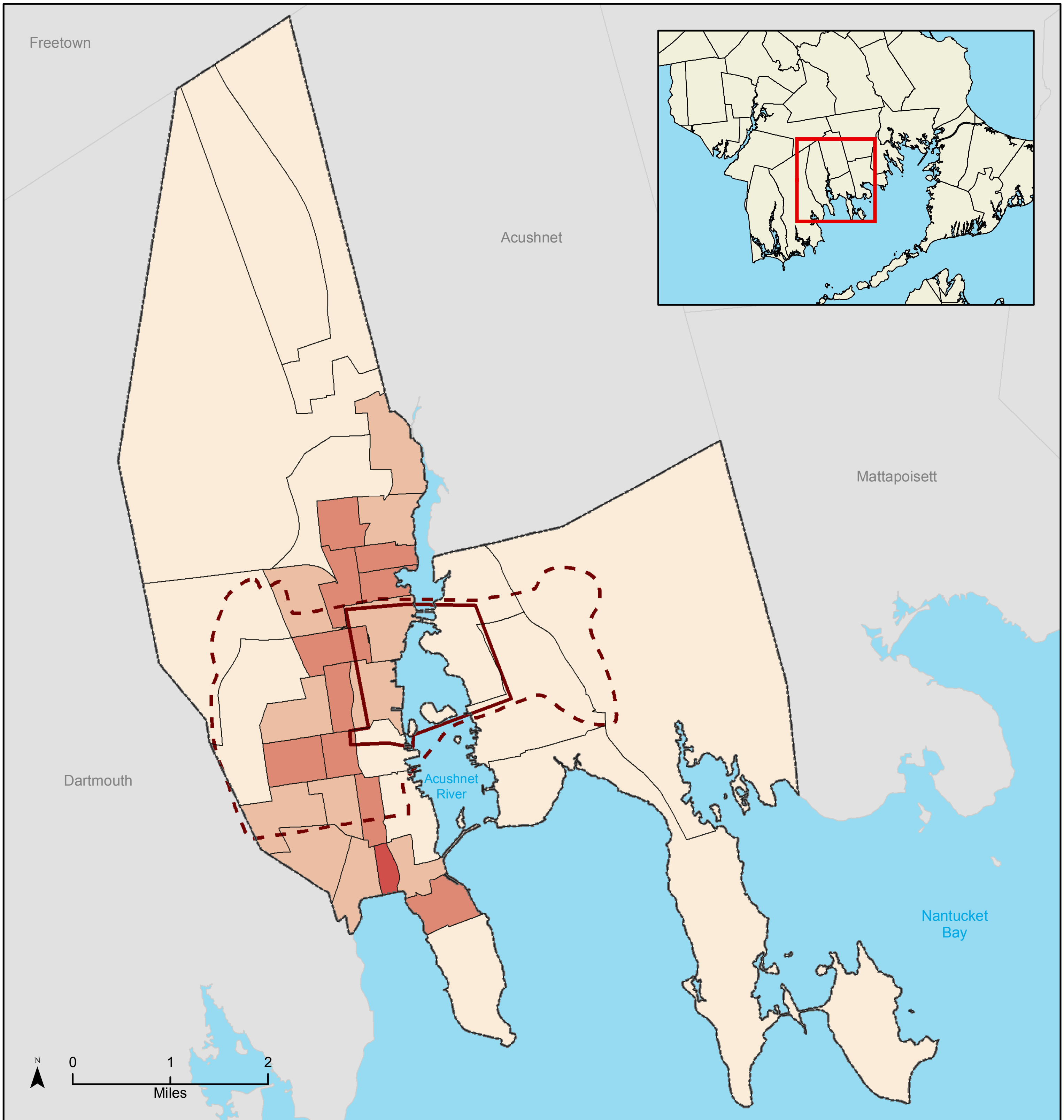
- 4% - 15%
- 16% - 25%
- 26% - 35% *
- 36% - 45%

Regional Study Area

Local Study Area

* Environmental Justice Threshold greater than 25%

Source: ACS 2012 5 YR Estimates



New Bedford-Fairhaven Bridge Corridor Study

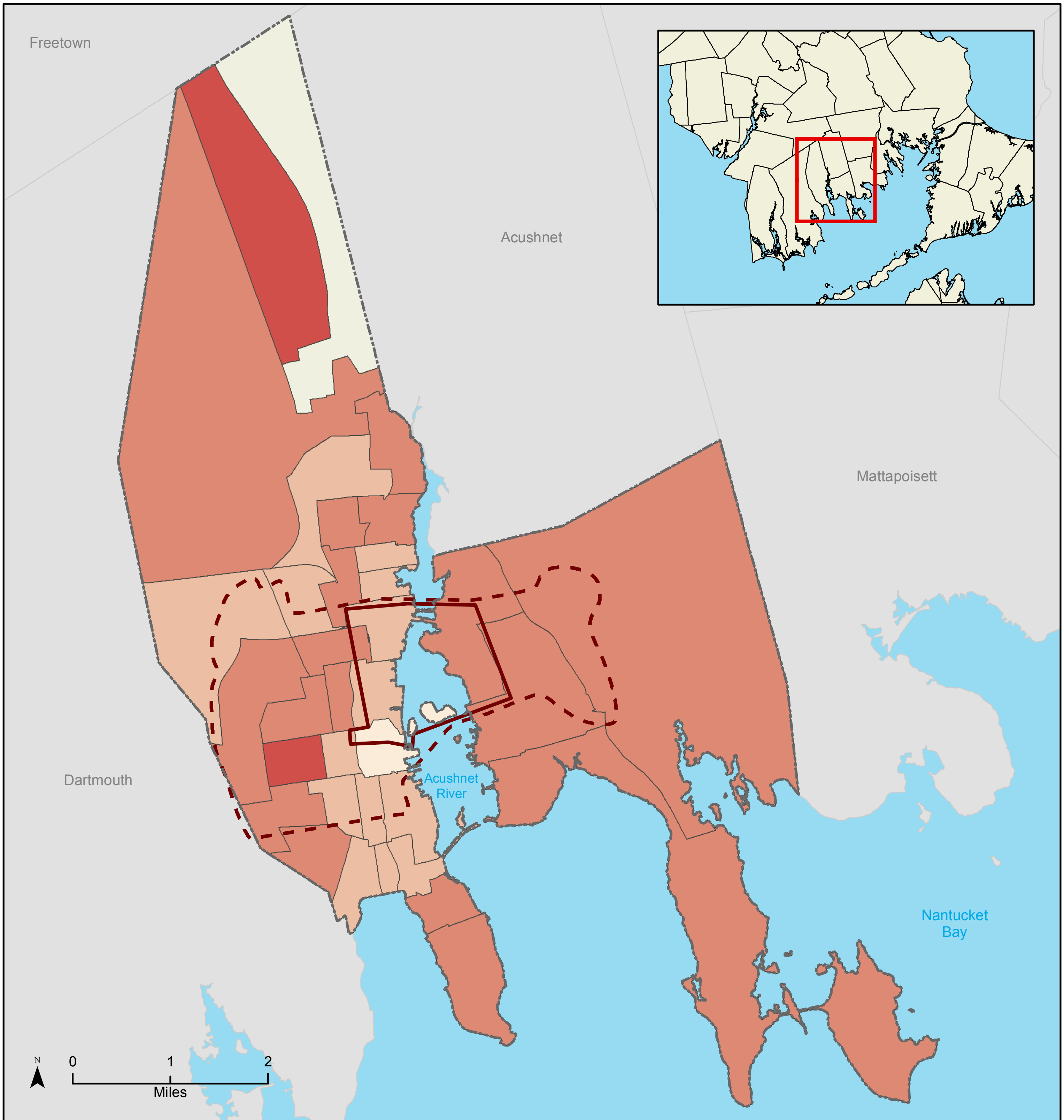
Population Density by Census Tract (People per Acre)

- 0.75 - 10
- 10.01 - 20
- 20.01 - 30
- 30.01 - 40.61

Regional Study Area

Local Study Area

Source: ACS 2012 5 YR Estimates



New Bedford-Fairhaven Bridge Corridor Study

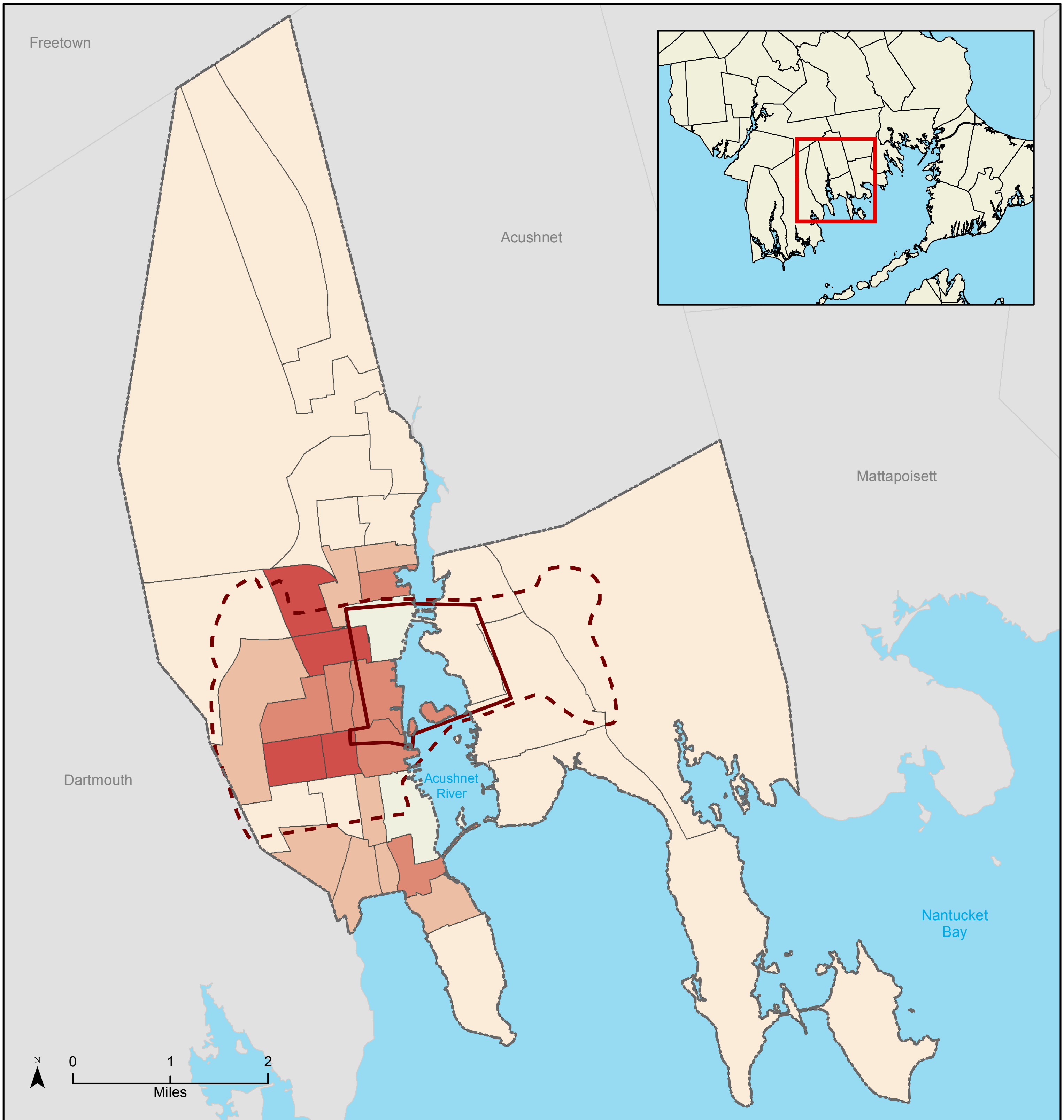
Total Population by Census Tract

- 1,500
- 1,597 - 3,000
- 3,001 - 4,500
- 4,501 - 6,115

Regional Study Area

Local Study Area

Source: ACS 2012 5 YR Estimates



New Bedford-Fairhaven Bridge Corridor Study

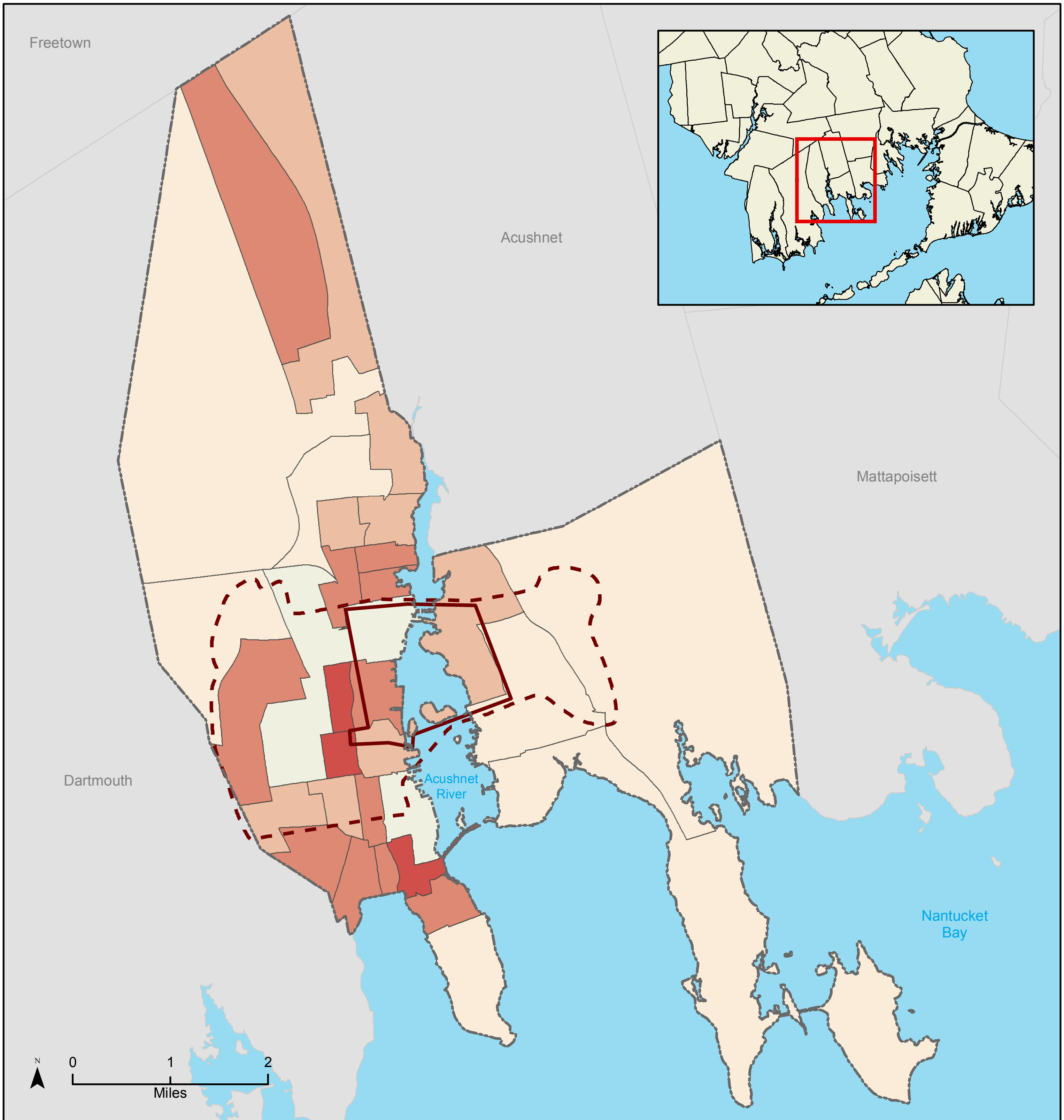
Source: ACS 2012 5 YR Estimates

Percent Minority Population by Census Tract

- 2% - 15%
- 16% - 25%
- 26% - 35% *
- 36% - 45%

* Environmental Justice Threshold greater than 25%

- Regional Study Area
- Local Study Area



New Bedford-Fairhaven Bridge Corridor Study

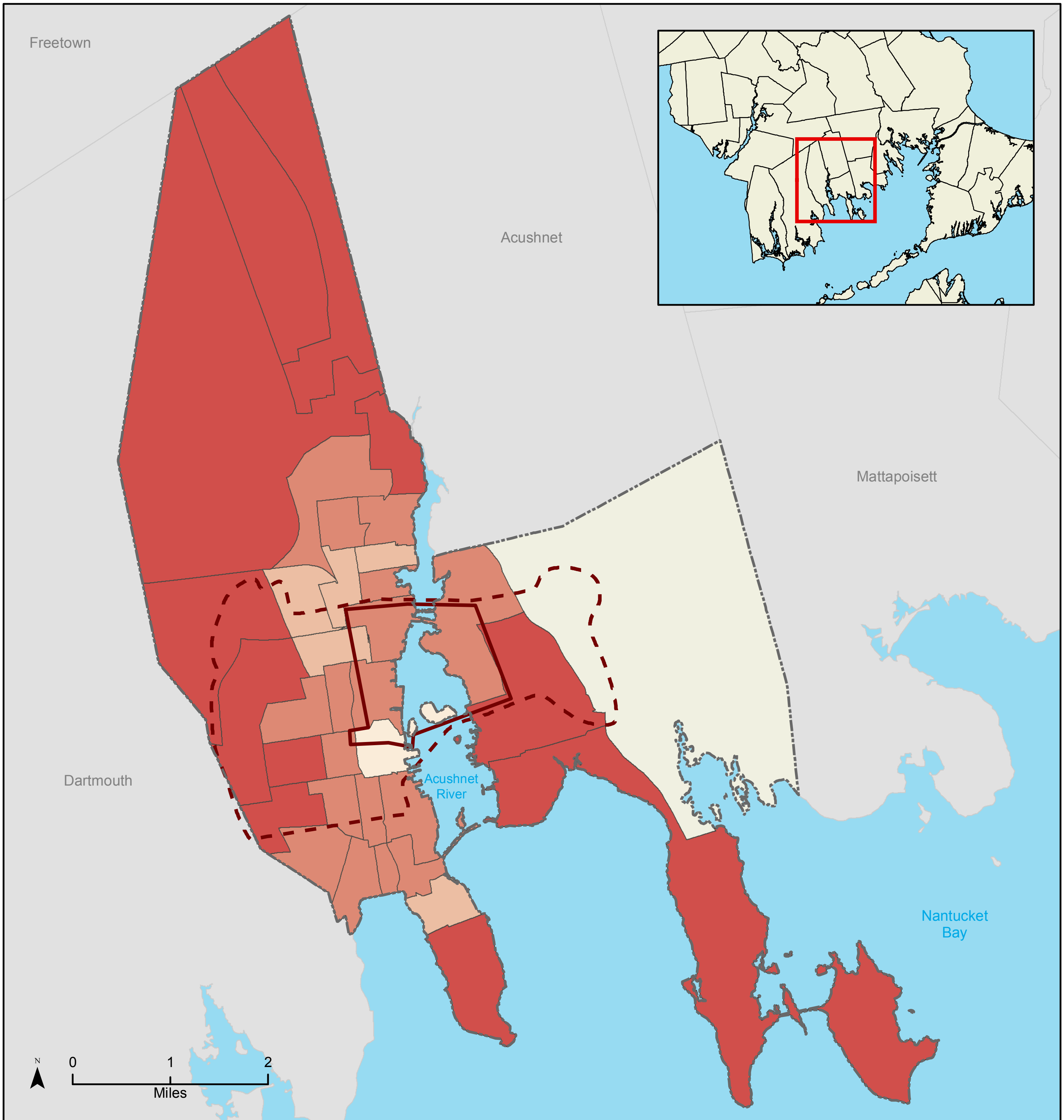
Total Minority Population by Census Tract

- 86 - 250
- 251 - 500
- 501 - 750
- 751 and greater

Regional Study Area

Local Study Area

Source: ACS 2012 5 YR Estimates



New Bedford-Fairhaven Bridge Corridor Study

Median Household Income by Census Tract

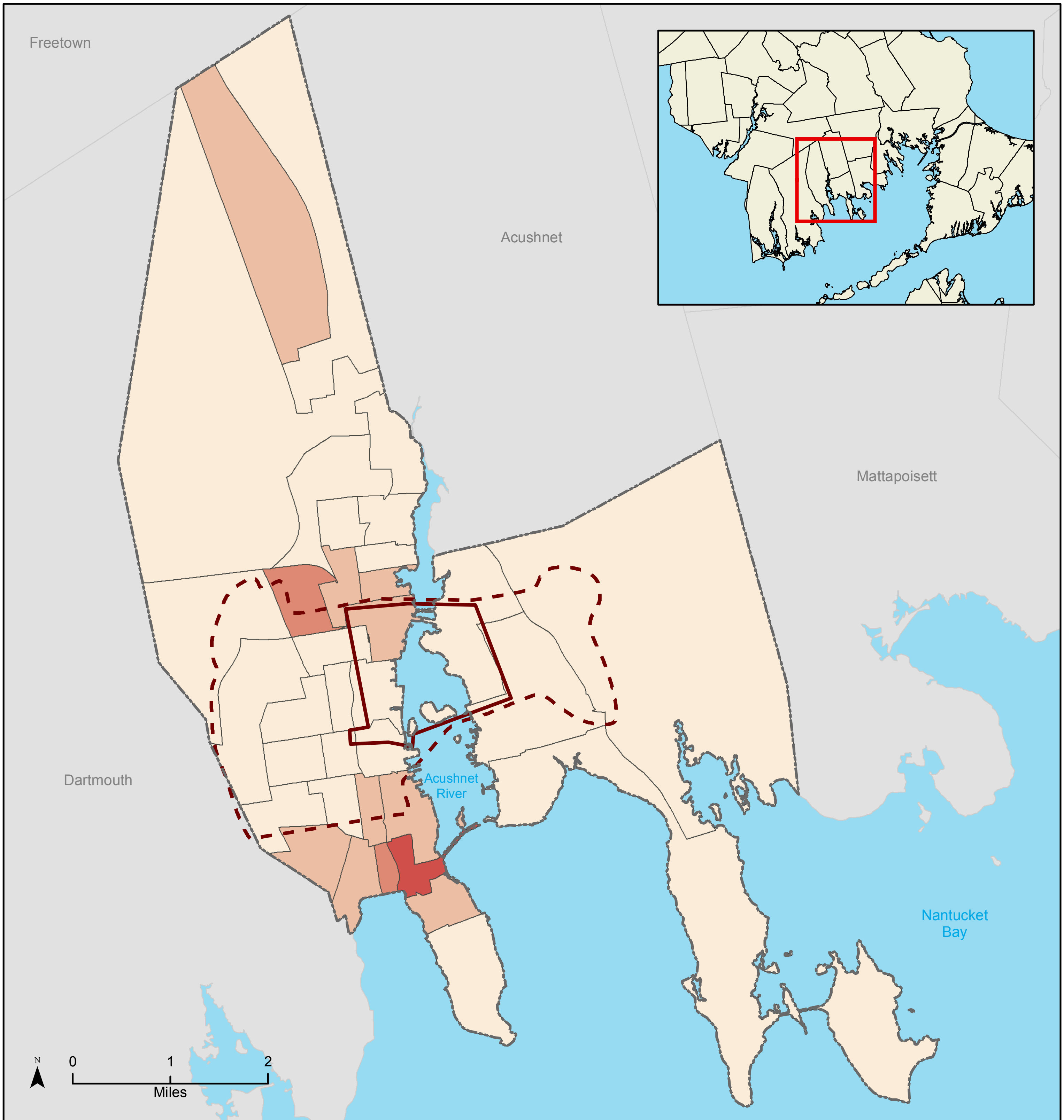
- 15,453
- 15,454 - 25,000
- 25,001 - 45,731
- 45,732 - 70,000

Regional Study Area

Local Study Area

Threshold for EJ is at $45,731 or less in income

Source: ACS 2012 5 YR Estimates



New Bedford-Fairhaven Bridge Corridor Study

Source: ACS 2012 5 YR Estimates

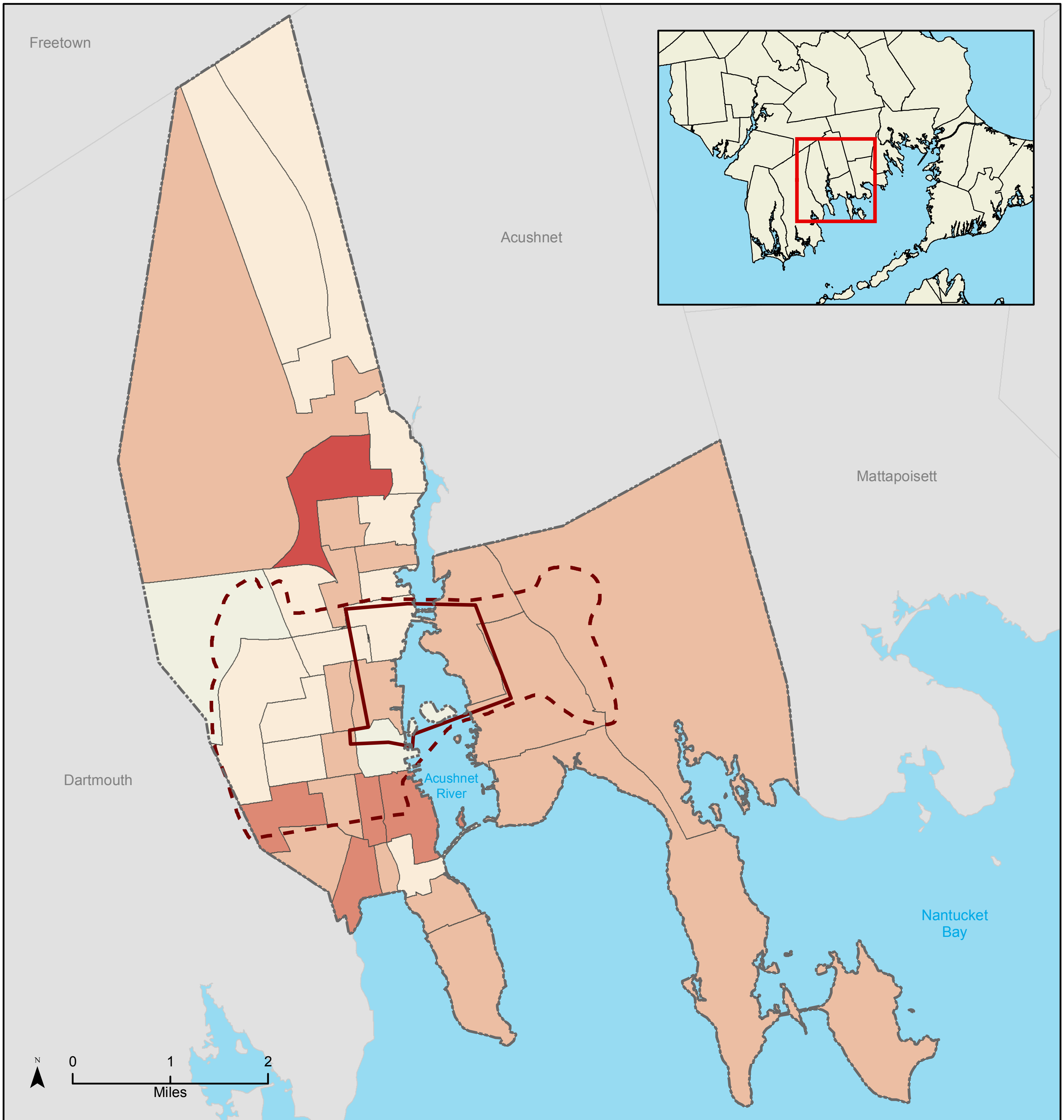
Percent of Population with Limited English Proficiency by Census Tract

- 1% - 15%
- 16% - 25%
- 26% - 35% *
- 36% - 45%

* Environmental Justice Threshold greater than 25%

Regional Study Area

Local Study Area



New Bedford-Fairhaven Bridge Corridor Study

Percent of Population Age 65 and Over by Census Tract

0.3% - 0.4%

0.5% - 0.6%

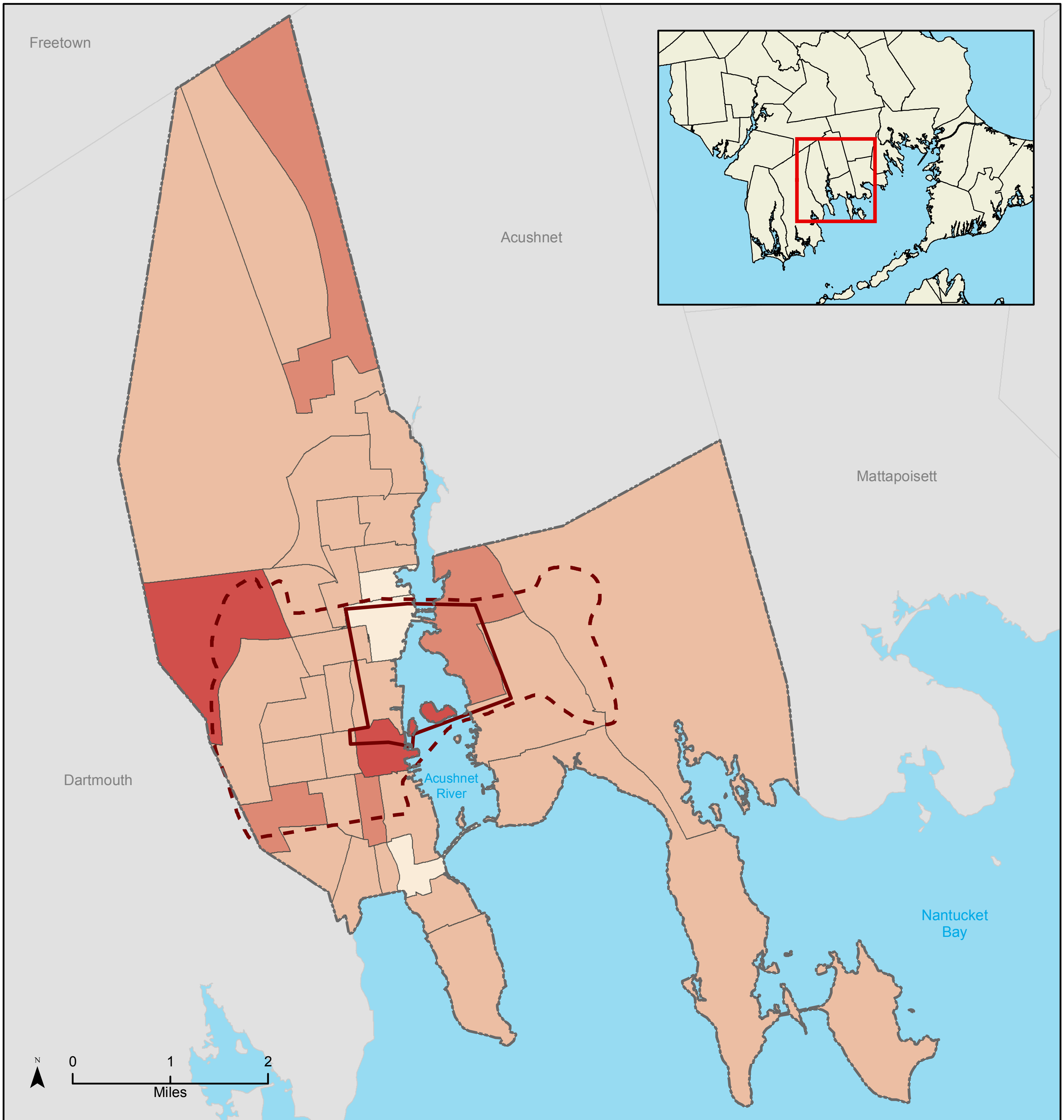
0.7% - 0.8%

0.9% and greater

Regional Study Area

Local Study Area

Source: ACS 2012 5 YR Estimates



New Bedford-Fairhaven Bridge Corridor Study

Population Age 65 and Over by Census Tract

6 - 10

11 - 20

21 - 30

31 and greater

Regional Study Area

Local Study Area

Source: ACS 2012 5 YR Estimates

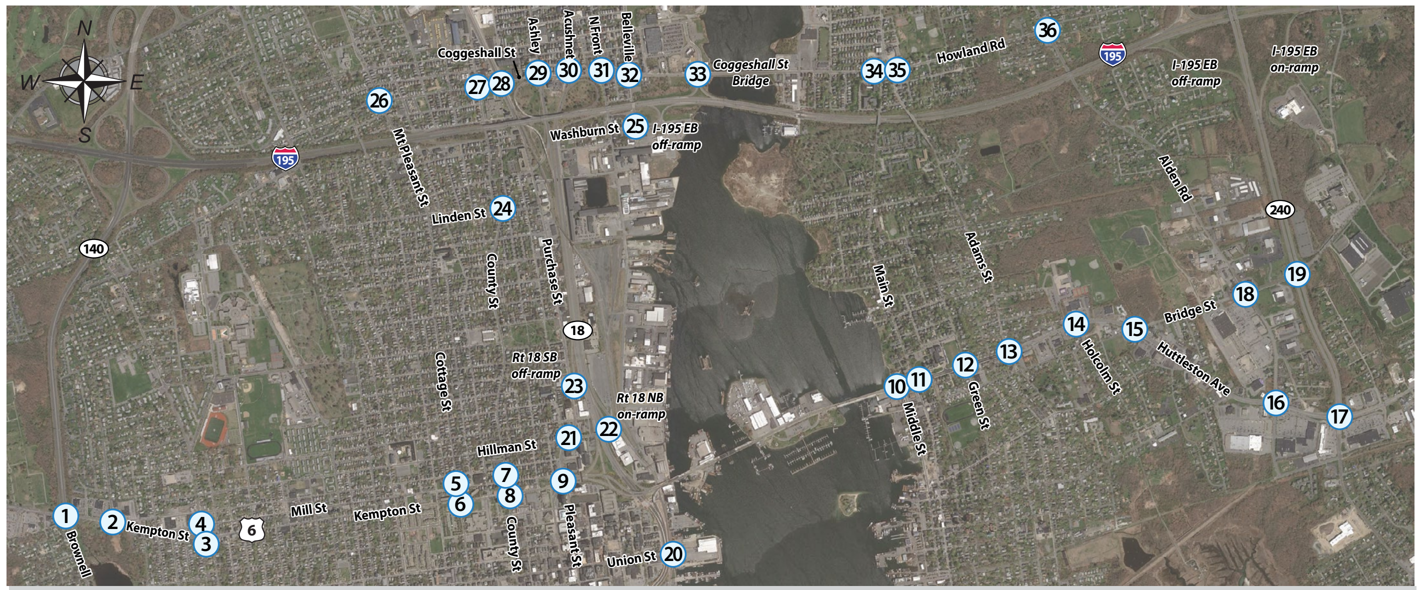
Appendix E
Traffic Volume Maps - 2035 No Build Conditions

2035 Route 6 | New Bedford - Fairhaven Corridor Study

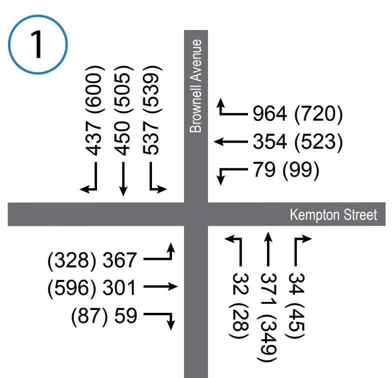
No Build AM (7:30-8:30AM) & PM (4:00-5:00 PM) Peak Volumes

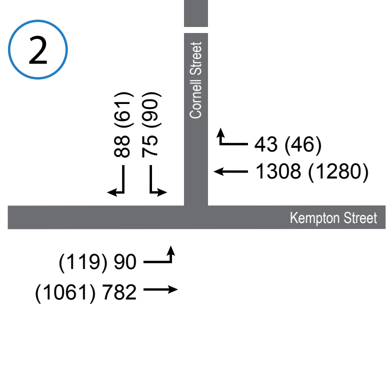
massDOT Massachusetts Department of Transportation Office of Transportation Planning

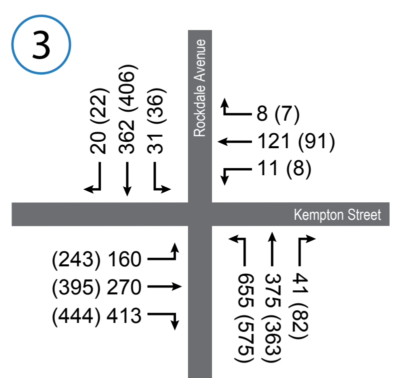
HDR

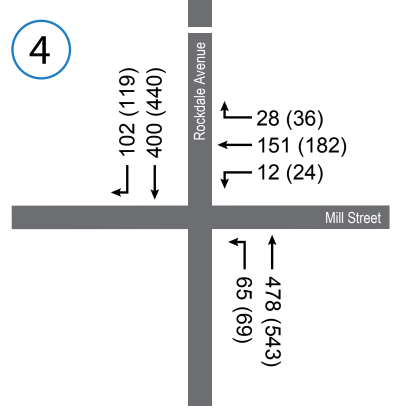


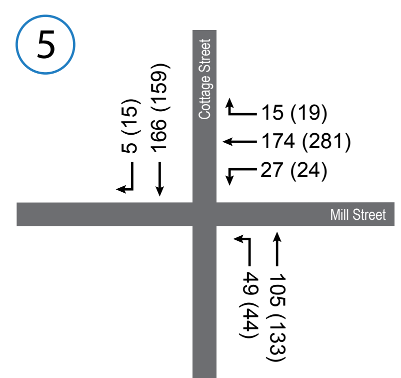
Legend: (X) Location ID
000 AM Peak Hour Volume
(000) PM Peak Hour Volume

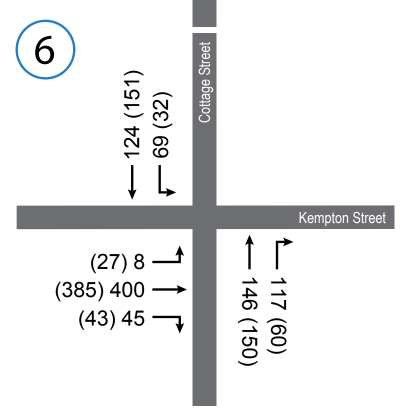


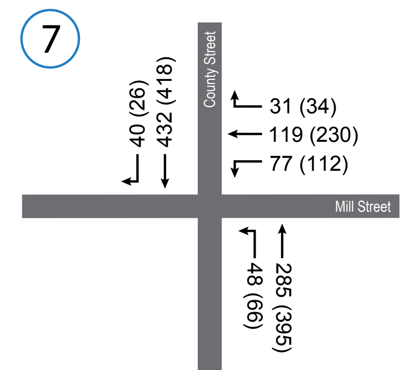


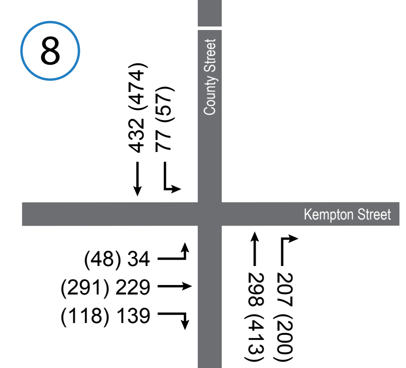


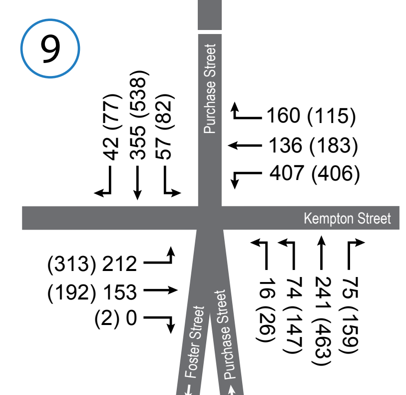


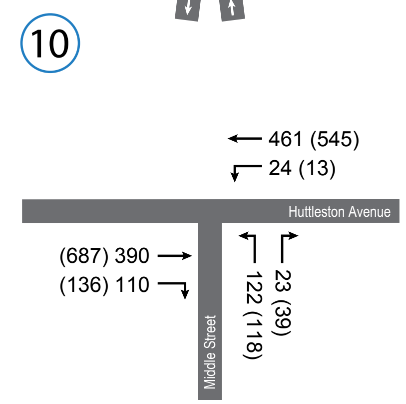


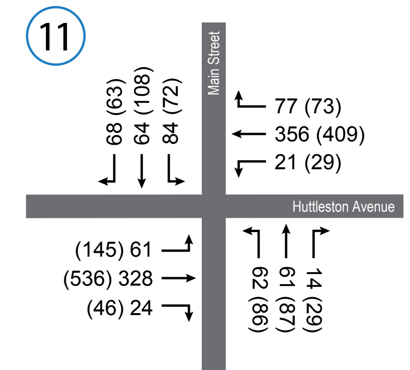


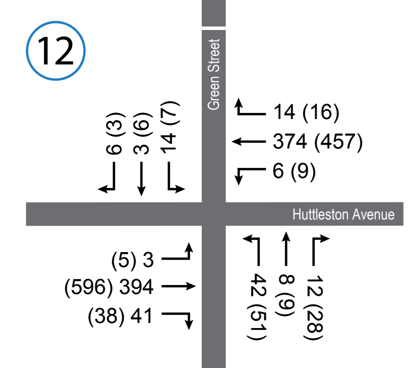


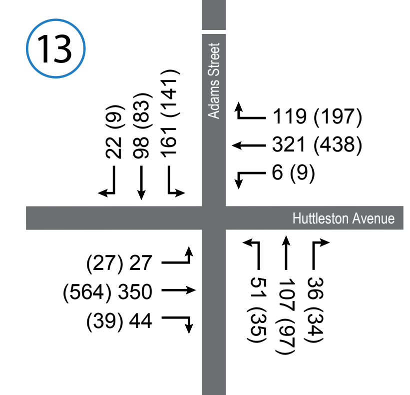


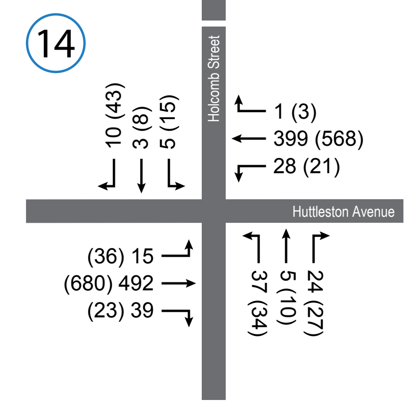


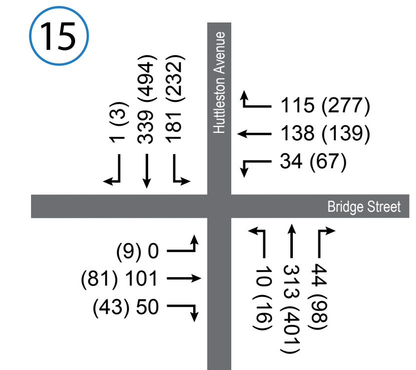


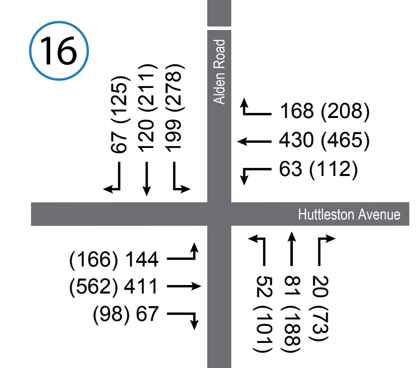


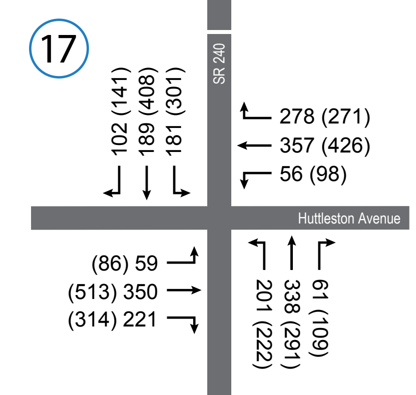


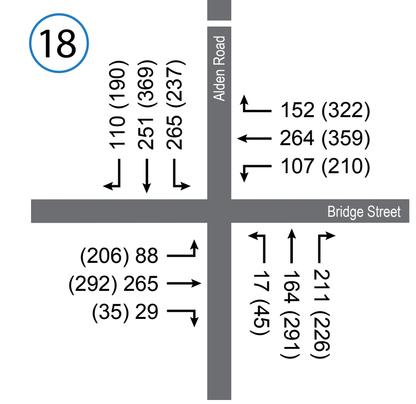










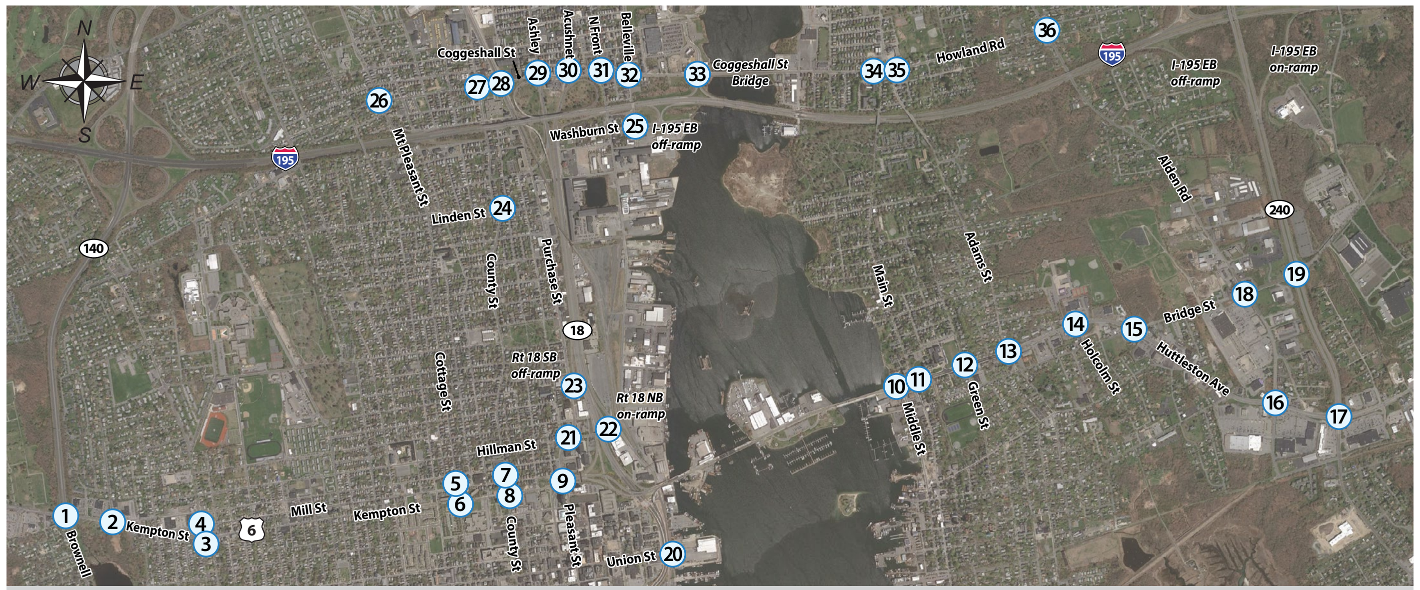


2035 Route 6 | New Bedford - Fairhaven Corridor Study

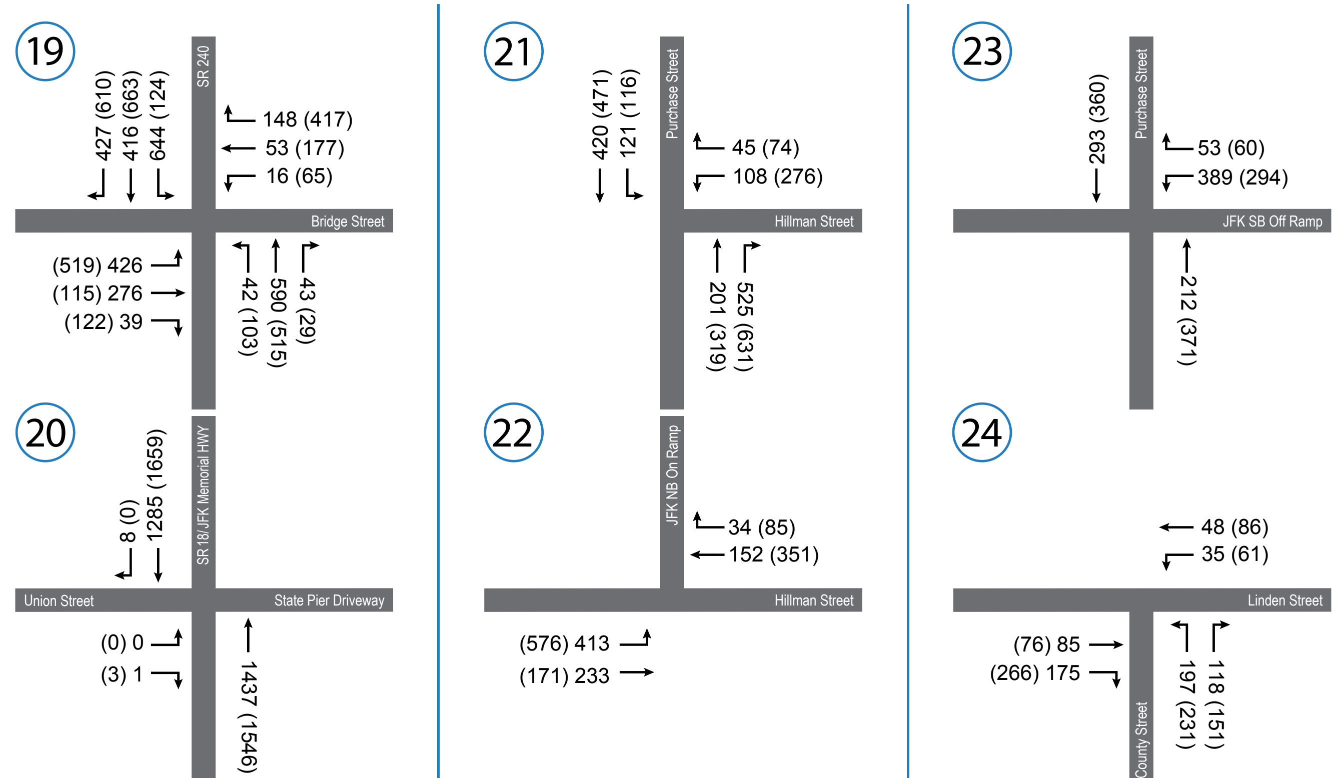
No Build AM (7:30-8:30AM) & PM (4:00-5:00 PM) Peak Volumes

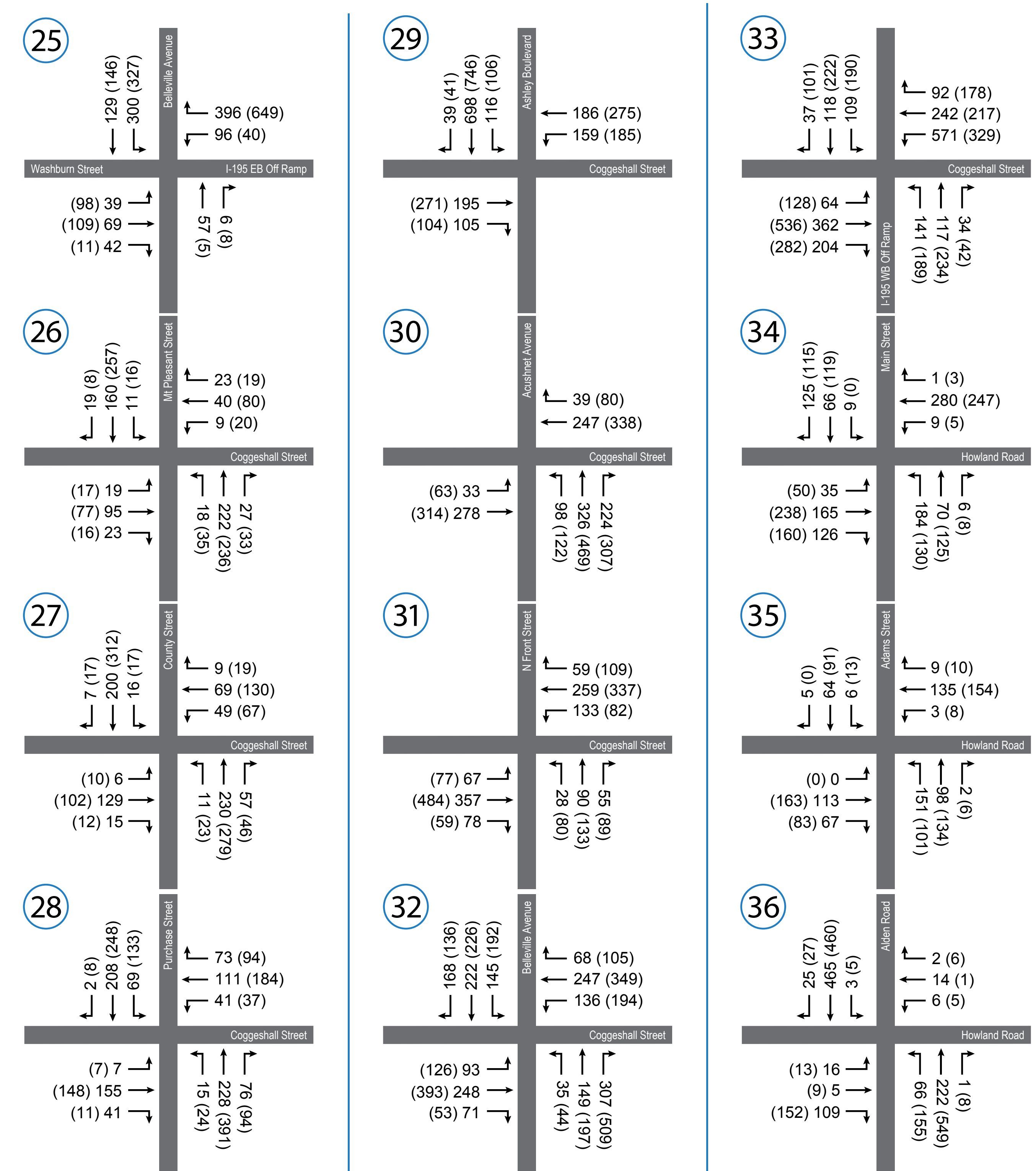
massDOT
Massachusetts Department of Transportation
Office of Transportation Planning

HDR



Legend: (X) Location ID
000 AM Peak Hour Volume
(000) PM Peak Hour Volume





NEW BEDFORD-FAIRHAVEN BRIDGE
CORRIDOR STUDY

Appendix F
Delay and Level of Service (LOS) Comparison Tables
Existing 2014 and 2035 No Build Conditon

Appendix F-1: Comparison of Existing and No Build Conditions - AM Peak Hour (7:30 AM to 8:00 AM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
1	Kempton St & Brownell Ave/Route 140	Kempton St	EBL	324	1.06	97.4	F					367	1.27	175.7	F				
			EBT	257	0.42	39.2	D	69.8	E			301	0.49	40.4	D	110.5	F		
			EBR	52								59							
			WBL	70	0.24	29.2	C					79	0.29	29.4	C				
			WBT	308	0.57	45.5	D	15.5	B			354	0.65	47.5	D	17.3	B		
			WBR	850	0.70	2.8	A			126.4	F	964	0.79	4.6	A			171.5	F
		Brownell Ave	NBL	28								32							
			NBT	327	1.26	183.1	F	183.1	F			371	1.49	280.6	F	280.6	F		
			NBR	30								34							
		Route140	SBL	468	9.92dl	374.1	F					537	11.38dl	485.4	F				
			SBT	397				248.2	F			450				322.7	F		
			SBR	385	0.31	0.5	A					437	0.35	0.6	A				
2	Kempton St & Cornell St	Kempton St	EBL	79	0.37	7.1	A	3.5	A			90	0.51	12.9	B	4.5	A		
			EBT	676	0.29	3.1	A					782	0.34	3.6	A				
			WBT	1150	0.65	10.4	B	10.4	B	11.0	B	1308	0.76	13.8	B	13.8	B	13.5	B
			WBR	38								43							
		Cornell St	SBL	65	0.67	49.5	D	49.5	D			75	0.74	53.1	D	53.1	D		
			SBR	78								88							
3	Kempton St & Rockdale Ave	Kempton St	EBL	141	0.75	53.6	D					160	0.67	41.4	D				
			EBT	224	0.64	42.7	D	26.4	C			270	0.61	37.4	D	22.8	C		
			EBR	364	0.30	6.7	A					413	0.34	7.0	A				
			WBL	10								11							
			WBT	107	0.40	38.1	D	38.1	D			121	0.36	33.2	C	33.2	C		
			WBR	7						53.8	D	8						82.1	F
		Rockdale Ave	NBL	578	0.83	28.9	C					655	1.09	92.3	F				
			NBT	331	0.38	8.8	A	20.9	C			375	0.47	13.0	B	60.5	E		
			NBR	35								41							
			SBL	26								31							
			SBT	319	1.31	217.4	F	217.4	F			362	1.51	299.0	F	299.0	F		
			SBR	18								20							
4	Mill St & Rockdale Ave	Mill St	WBL	11								12							
			WBT	129	0.81	59.6	E	59.6	E			151	0.83	58.8	E	58.8	E		
			WBR	25								28							
		Rockdale Ave	NBL	57	0.14	4.0	A	5.1	A	16.8	B	65	0.18	5.1	A	6.4	A	18.6	B
			NBT	422	0.42	5.3	A					478	0.50	6.6	A				
			SBT	352	0.41	12.6	B	11.9	B			400	0.49	16.2	B	15.1	B		
			SBR	90	0.08	9.2	A					102	0.10	11.2	B				
5	Mill St & Cottage St	Mill St	WBL	24								27							
			WBT	150	0.75	38.0	D	38.0	D			174	0.78	38.5	D	38.5	D		
			WBR	13								15							
		Cottage St	NBL	43	0.21	11.7	B	11.7	B	19.4	B	49	0.25	9.1	A	9.1	A	19.2	B
			NBT	93								105							
			SBT	144	0.19	6.2	A	6.2	A			166	0.22	7.4	A	7.4	A		
			SBR	4								5							
6	Kempton St & Cottage St	Kempton St	EBL	7	0.02	12.2	B					8	0.02	9.4	A				
			EBT	336	0.73	21.5	C	20.5	C			400	0.75	19.2	C	18.2	B		
			EBR	40	0.04	12.3	B					45	0.05	9.5	A				
		Cottage St	NBT	129	0.44	19.1	B	19.1	B	21.3	C	146	0.60	26.6	C	26.6	C	35.2	D
			NBR	100								117							
			SBL	59	0.52	25.3	C	25.3	C			69	0.99	78.4	E	78.4	E		
			SBT	109								124							

Appendix F-1: Comparison of Existing and No Build Conditions - AM Peak Hour (7:30 AM to 8:00 AM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
7	Mill St & County St	Mill St	WBL	68								77							
			WBT	101	0.80	44.1	D	44.1	D			119	0.78	38.8	D	38.8	D		
			WBR	27								31							
		County St	NBL	42	0.14	9.8	A	9.4	A	21.3	C	48	0.20	14.9	B	14.9	B	25.2	C
			NBT	251	0.26	9.3	A					285	0.32	14.9	B				
			SBT	375	0.57	17.6	B	17.6	B			432	0.72	25.1	C	25.1	C		
			SBR	35								40							
8	Kempton St & County St	Kempton St	EBL	30	0.25	34.4	C					34	0.21	30.5	C				
			EBT	179	0.67	40.0	D	39.5	D			229	0.72	37.9	D	37.3	D		
			EBR	123								139							
		County St	NBT	263	0.41	5.7	A	5.7	A	18.7	B	298	0.52	9.0	A	9.0	A	21.9	C
			NBR	166								207							
			SBL	62	0.48	13.7	B	13.7	B			77	0.64	21.1	C	21.1	C		
			SBT	381								432							
9	Kempton St/Mill St & Purchase St	Kempton St	EBL	187	0.83	88.9	F					212	0.95	108.1	F				
			EBT	95	0.41	62.0	E	78.4	E			153	0.66	70.6	E	90.3	F		
			EBR	0	-	-	-					0	-	-	-				
		Mill St	WBL	354	0.92	96.0	F					407	1.05	126.8	F				
			WBT	120	0.95	102.1	F	92.6	F			136	1.10	143.9	F	121.6	F		
			WBR	104	0.43	60.0	E			75.3	E	160	0.66	69.9	E			90.6	F
		Purchase St	NBL	75	0.29	55.7	E					90	0.35	57.0	E				
			NBT	209	0.39	56.3	E	55.2	E			241	0.45	57.4	E	56.2	E		
			NBR	62	0.05	51.2	D					75	0.06	51.3	D				
			SBL	44								57							
			SBT	307	0.73	66.1	E	66.1	E			355	0.87	75.6	E	75.6	E		
			SBR	35								42							
10	Huttleston Ave & Middle St	Huttleston Ave	EBT	295	0.26	6.3	A	6.3	A			390	0.36	7.7	A	7.7	A		
			EBR	88								110							
			WBL	21	0.37	7.3	A	7.3	A	9.0	A	24	0.49	7.9	A	7.9	A	9.7	A
			WBT	365								461							
		Middle St	NBL	98	0.37	27.2	C	27.2	C			122	0.42	26.1	C	26.1	C		
			NBR	20								23							
11	Huttleston Ave & Main St	Huttleston Ave	EBL	45	0.48	25.1	C					61	0.73	39.5	D				
			EBT	252	0.29	10.8	B	13.1	B			328	0.40	11.1	B	15.8	B		
			EBR	18								24							
			WBL	18	0.28	27.7	C					21	0.32	27.8	C				
			WBT	278	0.47	24.0	C	24.2	C			356	0.64	25.3	C	25.4	C		
			WBR	67						24.6	C	77						26.6	C
		Main St	NBL	49								62							
			NBT	53	0.63	32.5	C	32.5	C			61	0.71	34.7	C	34.7	C		
			NBR	12								14							
			SBL	72								84							
			SBT	55	0.77	39.5	D	39.5	D			64	0.83	44.3	D	44.3	D		
			SBR	59								68							

Appendix F-1: Comparison of Existing and No Build Conditions - AM Peak Hour (7:30 AM to 8:00 AM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
12	Huttleston Ave & Green St	Huttleston Ave	EBL	3								3							
			EBT	311	0.26	5.2	A	5.2	A			394	0.34	6.4	A	6.4	A		
			EBR	34								41							
			WBL	5								6							
			WBT	294	0.22	11.9	B	11.9	B			374	0.29	14.2	B	14.2	B		
			WBR	12						11.9	B	14						13.1	B
		Green St	NBL	36								42							
			NBT	7	0.46	35.7	D	35.7	D			8	0.50	35.3	D	35.3	D		
			NBR	10								12							
			SBL	12								14							
			SBT	3	0.37	37.3	D	37.3	D			3	0.32	35.9	D	35.9	D		
			SBR	5								6							
13	Huttleston Ave & Adams St	Huttleston Ave	EBL	23								27							
			EBT	275	0.84	39.7	D	39.7	D			350	0.94	47.2	D	47.2	D		
			EBR	35								44							
			WBL	5								6							
			WBT	248	0.58	32.4	C	32.4	C			321	0.71	33.1	C	33.1	C		
			WBR	103						43.8	D	119						76.9	E
		Adams St	NBL	44								51							
			NBT	92	0.94	79.3	E	79.3	E			107	1.13	139.7	F	139.7	F		
			NBR	31								36							
			SBL	139								161							
			SBT	85	0.95	44.4	D	44.4	D			98	1.22	136.4	F	136.4	F		
			SBR	19								22							
14	Huttleston Ave & Holcomb St	Huttleston Ave	EBL	13								15							
			EBT	398	0.27	3.9	A	3.9	A			492	0.35	5.2	A	5.2	A		
			EBR	34								39							
			WBL	24								28							
			WBT	315	0.22	3.7	A	3.7	A			399	0.29	4.9	A	4.9	A		
			WBR	1						7.0	A	1						7.7	A
		Holcomb St	NBL	32								37							
			NBT	4	0.50	30.0	C	30.0	C			5	0.47	27.9	C	27.9	C		
			NBR	21								24							
			SBL	4								5							
			SBT	3	0.13	27.9	C	27.9	C			3	0.12	25.8	C	25.8	C		
			SBR	9								10							
15	Huttleston Ave & Bridge St	Bridge St	EBL	0								0							
			EBT	87	0.37	20.5	C	20.5	C			101	0.43	20.9	C	20.9	C		
			EBR	43								50							
			WBL	29								34							
			WBT	119	0.71	27.8	C	27.8	C			138	0.83	35.8	D	35.8	D		
			WBR	99						15.1	B	115						17.4	B
		Huttleston Ave	NBL	9								10							
			NBT	241	0.21	8.4	A	8.4	A			313	0.27	9.0	A	9.0	A		
			NBR	38								44							
			SBL	156								181							
			SBT	266	0.47	9.9	A	9.9	A			339	0.60	11.8	B	11.8	B		
			SBR	1								1							

Appendix F-1: Comparison of Existing and No Build Conditions - AM Peak Hour (7:30 AM to 8:00 AM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
16	Huttleston Ave & Alden Rd	Huttleston Ave	EBL	124	0.60	38.1	D					144	0.59	35.6	D				
			EBT	328	0.31	17.2	B	22.3	C			411	0.41	20.0	B	23.6	C		
			EBR	58								67							
			WBL	54	0.50	52.7	D					63	0.54	50.8	D				
			WBT	342	0.53	23.9	C	26.8	C			430	0.78	29.9	C	31.9	C		
			WBR	145						29.2	C	168						31.8	C
		Alden Rd	NBL	45								52							
			NBT	70	0.47	39.1	D	39.1	D			81	0.52	39.0	D	39.0	D		
			NBR	17								20							
			SBL	172								199							
			SBT	104	0.73	39.8	D	39.8	D			120	0.78	41.4	D	41.4	D		
			SBR	58								67							
17	Huttleston Ave & Route 240	Huttleston Ave	EBL	51	0.21	17.6	B					59	0.30	22.8	C				
			EBT	285	0.29	24.2	C	15.2	B			350	0.40	30.2	C	19.1	B		
			EBR	181	0.14	0.2	A					221	0.18	0.2	A				
		Route 6	WBL	48	0.16	14.5	B					56	0.23	16.7	B				
			WBT	279	0.33	20.5	C	12.7	B			357	0.46	24.5	C	15.6	B		
			WBR	240	0.17	0.3	A			20.1	C	278	0.20	0.3	A			21.5	C
		Route 240	NBL	174	0.59	26.1	C					201	0.64	26.1	C				
			NBT	292	0.69	39.2	D	29.6	C			338	0.73	39.2	D	29.5	C		
			NBR	53	0.05	0.1	A					61	0.06	0.1	A				
			SBL	156	0.61	25.7	C					181	0.65	24.3	C				
			SBT	163	0.40	33.9	C	23.9	C			189	0.40	32.0	C	22.5	C		
			SBR	88	0.06	0.1	A					102	0.07	0.1	A				
18	Bridge St & Alden Rd	Bridge St	EBL	76	0.67	44.3	D					88	0.77	57.2	E				
			EBT	229	0.78	36.7	D	38.4	D			265	0.87	45.5	D	48.1	D		
			EBR	25								29							
			WBL	92	0.58	35.8	D					107	0.68	41.5	D				
			WBT	228	0.70	29.6	C	24.6	C			264	0.77	33.7	C	27.7	C		
			WBR	131	0.15	10.3	B			44.0	D	152	0.17	10.3	B			60.2	E
		Alden Rd	NBL	15	0.62	54.9	D					17	0.71	77.9	E				
			NBT	142	0.64	32.8	C	26.0	C			164	0.75	40.5	D	31.2	C		
			NBR	182	0.13	16.4	B					211	0.17	17.1	B				
			SBL	229	1.20	155.5	F					265	1.41	243.2	F				
			SBT	217	0.64	25.2	C	74.5	E			251	0.75	31.0	C	111.9	F		
			SBR	95	0.09	11.2	B					110	0.10	11.7	B				
19	Bridge St & Route 240	Bridge St	EBL	368	1.02	103.6	F					426	1.17	150.7	F				
			EBT	238	0.95	79.8	E	86.3	F			276	1.09	118.9	F	125.7	F		
			EBR	34	0.04	28.0	C					39	0.04	26.7	C				
			WBL	14	0.20	51.3	D					16	0.22	50.9	D				
			WBT	46	0.49	54.1	D	51.4	D			53	0.55	55.6	E	51.4	D		
			WBR	128	0.10	50.5	D			114.8	F	148	0.11	50.0	D			157.6	F
		Route 240	NBL	36	0.87	131.1	F					42	0.81	101.0	F				
			NBT	510	0.91	63.1	E	66.0	E			590	1.10	114.8	F	108.0	F		
			NBR	37	0.03	32.4	C					43	0.03	32.7	C				
			SBL	556	1.53	292.1	F					644	1.76	389.7	F				
			SBT	359	0.73	47.1	D	156.0	F			416	0.93	68.6	E	206.8	F		
			SBR	369	0.23	39.3	D					427	0.27	40.8	D				
20	Union St & Route 18	Union St	EBL	0	0.06	28.4	C	28.4	C			0	0.07	32.1	C	32.1	C		
			EBR	1								1							
		Route 18	NBL	0	0.55	2.8	A	2.8	A	2.7	A	0	0.61	2.9	A	2.9	A	2.8	A
			NBT	1255								1437							
			SBT	1124	0.51	2.6	A	2.6	A			1285	0.56	2.6	A	2.6	A		
			SBR	7								8							

Appendix F-1: Comparison of Existing and No Build Conditions - AM Peak Hour (7:30 AM to 8:00 AM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
21	Hillman St & Purchase St	Hillman St	WBL	80	0.30	16.4	B	16.4	B			108	0.42	18.3	B	18.3	B		
			WBR	34								45							
		Purchase St	NBT	177	0.28	9.7	A	9.6	A	11.2	B	201	0.32	10.1	B	10.5	B	12.2	B
			NBR	384	0.28	9.6	A					525	0.38	10.7	B				
			SBL	88	0.21	9.3	A	11.3	B			121	0.30	10.3	B	12.3	B		
			SBT	370	0.49	11.9	B					420	0.56	12.9	B				
22	Hillman St & NB JFK Memorial Hwy On Ramp	Hillman St	EBLT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			WBTR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	Purchase St & SB JFK Memorial Hwy Off Ramp	JFK Memorial Hwy Off Ramp	WBL	340	-	53.3	F	53.3	F			389	-	136.5	F	136.5	F		
			WBR	47								53							
		Purchase St	NBT	182	-	0.0	-	0.0	-	25.9	D	212	-	0.0	-	0.0	-	65.6	F
			NBR	0								0							
			SBL	0	-	0.0	-	0.0	-			0	-	0.0	-	0.0	-		
			SBT	249								293							
24	Linden St & County St	Linden St	EBT	75	-	10.1	B	10.1	B			85	-	11.1	B	11.1	B		
			EBR	154								175							
			WBL	25	-	9.2	A	9.2	A	10.8	B	35	-	9.7	A	9.7	A	12.1	B
			WBT	42								48							
		County St	NBL	174	-	11.7	B	11.7	B			197	-	13.4	B	13.4	B		
			NBR	104								118							
25	Washburn St & Belleville Ave	Washburn St	EBL	34								39							
			EBT	61	-	60.0	F	60	F			69	-	159.1	F	159.1	F		
			EBR	37								42							
			WBL	85	-	36.5	E	36.5	E			96	-	90.7	F	90.7	F		
			WBR	349						26.3	D	396						63.4	F
		Belleville Ave	NBT	50	-	0.0	0.0	0.0	0.0			57	-	0.0	0.0	0.0	0.0		
			NBR	5								6							
			SBL	265	-	6.4	A	6.4	A			300	-	6.6	A	6.6	A		
			SBT	114								129							
26	Coggeshall St & Mt. Pleasant	Coggeshall St	EBL	17								19							
			EBT	84	-	11.0	B	11.0	B			95	-	12.1	B	12.1	B		
			EBR	20								23							
			WBL	8								9							
			WBT	34	-	9.8	A	9.8	A			40	-	10.5	B	10.5	B		
			WBR	20						11.7	B	23						13.4	B
		Mt. Pleasant	NBL	16								18							
			NBT	196	-	13.0	B	13.0	B			222	-	15.3	C	15.3	C		
			NBR	24								27							
			SBL	10								11							
			SBT	141	-	11.3	B	11.3	B			160	-	12.7	B	12.7	B		
			SBR	17								19							
27	Coggeshall St & County St	Coggeshall St	EBL	5								6							
			EBT	114	0.26	11.1	B	11.1	B			129	0.30	11.5	B	11.5	B		
			EBR	13								15							
			WBL	42								49							
			WBT	59	0.25	11.0	B	11.0	B			69	0.29	11.5	B	11.5	B		
			WBR	8						12.2	B	9						12.9	B
		County St	NBL	10								11							
			NBT	203	0.46	13.2	B	13.2	B			230	0.53	14.2	B	14.2	B		
			NBR	50								57							
			SBL	14								16							
			SBT	176	0.36	12.2	B	12.2	B			200	0.41	12.9	B	12.9	B		
			SBR	6								7							

Appendix F-1: Comparison of Existing and No Build Conditions - AM Peak Hour (7:30 AM to 8:00 AM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
28	Coggeshall St & Purchase St	Coggeshall St	EBL	6								7							
			EBT	137	0.20	4.8	A	4.8	A			155	0.23	5.0	A	5.0	A		
			EBR	35								41							
			WBL	36								41							
			WBT	94	0.25	5.1	A	5.1	A			111	0.30	5.5	A	5.5	A		
			WBR	62						170.0	F	73						261.5	F
		Purchase St	NBL	13								15							
			NBT	195	1.39	220.2	F	220.2	F			228	1.68	345.6	F	345.6	F		
			NBR	67								76							
			SBL	59								69							
			SBT	177	1.73	375.1	F	375.1	F			208	2.17	568.5	F	568.5	F		
			SBR	2								2							
29	Coggeshall St & Ashley Blvd	Coggeshall St	EBT	170	0.45	18.6	B	18.6	B			195	0.52	19.9	B	19.9	B		
			EBR	93								105							
			WBL	139	0.80	36.1	D	36.1	D			159	1.06	88.7	F	88.7	F		
			WBT	158						21.9	C	186						34.4	C
		Ashley Blvd	SBL	97	0.69	18.8	B					116	0.80	22.3	C				
			SBT	604				18.3	B			698				21.7	C		
			SBR	34	0.04	11.0	B					39	0.05	11.1	B				
30	Coggeshall St & Acuschnet Ave	Coggeshall St	EBL	29	0.11	8.3	A	10.3	B			33	0.15	10.1	B	12.6	B		
			EBT	238	0.37	10.6	B					278	0.44	13.0	B				
			WBT	211	0.58	20.3	C	20.3	C			247	0.74	27.9	C	27.9	C		
			WBR	31						18.1	B	39						20.6	C
		Acushnet Ave	NBL	86	0.22	16.9	B	20.6	C			98	0.23	16.2	B	20.8	C		
			NBT	279	0.71	24.5	C					326	0.75	25.4	C				
			NBR	197	0.18	16.6	B					224	0.21	16.1	B				
31	Coggeshall St & N Front St	Coggeshall St	EBL	59								67							
			EBT	315	-	1.8	A	1.8	A			357	-	1.9	A	1.9	A		
			EBR	61								78							
			WBL	92								133							
			WBT	228	-	2.9	A	2.9	A	7.3	A	259	-	4.0	A	4.0	A	19.0	C
			WBR	52								59							
		N. Front Street	NBL	14								28							
			NBT	73	-	39.9	E	39.9	E			90	-	111.5	F	111.5	F		
			NBR	42								55							
32	Coggeshall St & Belleville Ave	Coggeshall St	EBL	81	0.19	14.1	B					93	0.22	13.6	B				
			EBT	213	0.73	29.9	C	26.9	C			248	0.76	30.5	C	27.3	C		
			EBR	63								71							
			WBL	120	0.39	13.4	B					136	0.46	13.6	B				
			WBT	208	0.52	21.7	C	18.5	B			247	0.56	21.8	C	18.6	B		
			WBR	60	0.06	17.4	B			27.6	C	68	0.06	16.5	B			49.5	D
		Belleville Ave	NBL	31	0.46	23.1	C					35	0.66	31.6	C				
			NBT	131				21.7	C			149				26.4	C		
			NBR	271	0.24	20.9	C					307	0.28	23.4	C				
			SBL	128								145							
			SBT	196	0.88	40.8	D	40.8	D			222	1.14	112.0	F	112.0	F		
			SBR	133								168							

Appendix F-1: Comparison of Existing and No Build Conditions - AM Peak Hour (7:30 AM to 8:00 AM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
33	Coggeshall St & I-195 Off Ramp	Coggeshall St	EBL	56	0.17	14.7	B					64	0.18	13.2	B				
			EBT	316	0.76	28.8	C	18.8	B			362	0.72	25.4	C	16.6	B		
			EBR	178	0.15	0.2	A					204	0.17	0.3	A				
			WBL	504	1.26	147.2	F					571	1.41	214.3	F				
			WBT	204	0.53	17.1	B	97.1	F			242	0.55	16.4	B	136.4	F		
			WBR	81						56.6	E	92						79.0	E
		195 Off Ramp	NBL	124	0.37	28.2	C					141	0.46	33.6	C				
			NBT	103	0.55	34.1	C	31.6	C			117	0.70	44.3	D	39.7	D		
			SBL	96	0.79	61.9	E	50.9	D			109	0.99	122.3	F	98.0	F		
			SBR	137	0.76	51.6	D					155	0.96	105.2	F				
34	Howland Rd & Main St	Howland Rd	EBL	30								35							
			EBT	140	0.79	49.0	D	49.0	D			165	0.97	78.7	E	78.7	E		
			EBR	109								126							
			WBL	8								9							
			WBT	232	0.40	4.9	A	4.9	A			280	0.47	5.0	A	5.0	A		
			WBR	1						50.8	D	1						93.3	F
		Main St	NBL	159								184							
			NBT	53	0.98	100.2	F	100.2	F			70	1.32	222.1	F	222.1	F		
			NBR	5								6							
			SBL	8								9							
			SBT	57	0.78	69.2	E	69.2	E			66	0.97	108.5	F	108.5	F		
			SBR	108								125							
35	Howland Rd & Adams St	Howland Rd	EBL	0								0							
			EBT	95	0.20	0.4	A	0.4	A			113	0.24	0.5	A	0.5	A		
			EBR	58								67							
			WBL	3								3							
			WBT	107	0.41	42.6	D	42.6	D			135	0.52	46.4	D	46.4	D		
			WBR	8						41.4	D	9						52.3	D
		Adams St	NBL	130								151							
			NBT	85	0.86	69.9	E	69.9	E			98	1.00	100.9	F	100.9	F		
			NBR	2								2							
			SBL	5								6							
			SBT	55	0.52	50.1	D	50.1	D			64	0.57	50.9	D	50.9	D		
			SBR	4								5							
36	Howland Rd & Alden Rd	Howland Rd	EBL	14								16							
			EBT	2	-	17.9	C	17.9	C			5	-	25.4	D	25.4	D		
			EBR	94								109							
		Nancy St	WBL	5								6							
			WBT	3	-	26.9	D	26.9	D			14	-	38.1	E	38.1	E		
			WBR	2						4.2	A	2						6.1	A
		Alden Rd	NBL	57								66							
			NBT	192	-	2.7	A	2.7	A			222	-	3.0	A	3.0	A		
			NBR	1								1							
			SBL	3								3							
			SBT	402	-	0.2	A	0.2	A			465	-	0.2	A	0.2	A		
			SBR	22								25							

Legend			
LOS	Mid LOS D	E	F
Delay (Signalized)	45 - 55	55 - 80	>80
Delay (Unsignalized)	30 - 35	35 - 50	>50

Appendix F-2: Comparison of Existing and No Build Conditions - PM Peak Hour (4:00 PM to 5:00 PM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
1	Kempton St & Brownell Ave/Route 140	Kempton St	EBL	289	1.72	398.3	F					328	1.95	497.8	F				
			EBT	513	0.78	48.3	D	161.6	F			596	0.91	59.3	E	199.2	F		
			EBR	77								87							
			WBL	87	0.75	68.7	E					99	0.82	77.2	E				
			WBT	455	0.61	43.6	D	23.8	C			523	0.70	45.8	D	25.8	C		
			WBR	635	0.47	1.1	A			166.5	F	720	0.53	1.4	A			211.5	F
		Brownell Ave	NBL	25								28							
			NBT	308	1.15	143.7	F	143.7	F			349	1.34	218.2	F	218.2	F		
			NBR	40								45							
		Route140	SBL	475	9.53dl	463.0	F					539	11.02dl	586.4	F				
			SBT	445				288.1	F			505				364.8	F		
			SBR	529	0.38	0.7	A					600	0.43	0.8	A				
2	Kempton St & Cornell St	Kempton St	EBL	105	0.38	4.4	A	3.3	A			119	0.50	6.8	A	4.0	A		
			EBT	923	0.36	3.2	A					1061	0.42	3.6	A				
			WBT	1123	0.56	8.4	A	8.4	A	9.0	A	1280	0.64	10.2	B	10.2	B	10.6	B
			WBR	41								46							
		Cornell St	SBL	79	0.71	54.0	D	54.0	D			90	0.78	60.8	E	60.8	E		
			SBR	54								61							
3	Kempton St & Rockdale Ave	Kempton St	EBL	214	0.61	30.7	C					243	0.75	39.5	D				
			EBT	336	0.61	30.1	C	23.0	C			395	0.75	36.6	D	27.9	C		
			EBR	392	0.30	12.3	B					444	0.34	13.5	B				
			WBL	7								8							
			WBT	80	0.25	24.8	C	24.8	C			91	0.35	27.1	C	27.1	C		
			WBR	6						56.8	E	7						76.2	E
		Rockdale Ave	NBL	507	1.23	145.9	F					575	1.42	222.5	F				
			NBT	320	0.50	19.2	B	90.6	F			363	0.55	19.3	B	133.8	F		
			NBR	72								82							
			SBL	32								36							
			SBT	358	0.95	74.4	E	74.4	E			406	1.04	81.8	F	81.8	F		
			SBR	19								22							
4	Mill St & Rockdale Ave	Mill St	WBL	21								24							
			WBT	155	0.56	36.2	D	36.2	D			182	0.54	31.4	C	31.4	C		
			WBR	32								36							
		Rockdale Ave	NBL	61	0.17	5.7	A	7.6	A	16.8	B	69	0.26	9.3	A	13.3	B	21.4	C
			NBT	479	0.49	7.9	A					543	0.61	13.8	B				
			SBT	388	0.50	19.6	B	18.2	B			440	0.65	27.7	C	25.3	C		
			SBR	105	0.13	14.2	B					119	0.17	18.5	B				
5	Mill St & Cottage St	Mill St	WBL	21								24							
			WBT	242	0.77	27.9	C	27.9	C			281	0.80	27.2	C	27.2	C		
			WBR	17								19							
		Cottage St	NBL	39	0.21	5.3	A	5.3	A	16.5	B	44	0.26	6.5	A	6.5	A	17.0	B
			NBT	117								133							
			SBT	140	0.19	7.7	A	7.7	A			159	0.23	9.2	A	9.2	A		
			SBR	13								15							
6	Kempton St & Cottage St	Kempton St	EBL	24	0.07	11.5	B					27	0.06	7.5	A				
			EBT	327	0.72	19.6	B	18.2	B			385	0.66	12.6	B	11.8	B		
			EBR	38	0.04	11.4	B					43	0.05	7.5	A				
		Cottage St	NBT	132	0.27	12.2	B	12.2	B	14.4	B	150	0.42	19.0	B	19.0	B	14.0	B
			NBR	53								60							
			SBL	28	0.28	7.7	A	7.7	A			32	0.46	14.0	B	14.0	B		
			SBT	133								151							

Appendix F-2: Comparison of Existing and No Build Conditions - PM Peak Hour (4:00 PM to 5:00 PM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
7	Mill St & County St	Mill St	WBL	99								112							
			WBT	197	0.70	22.3	C	22.3	C			230	0.68	17.3	B	17.3	B		
			WBR	30								34							
		County St	NBL	58	0.28	8.8	A	11.8	B	23.3	C	66	0.50	12.2	B	17.3	B	49.6	D
			NBT	348	0.48	12.3	B					395	0.66	18.3	B				
			SBT	369	0.81	36.6	D	36.6	D			418	1.14	115.1	F	115.1	F		
			SBR	23								26							
8	Kempton St & County St	Kempton St	EBL	42	0.24	27.4	C					48	0.24	25.7	C				
			EBT	244	0.65	31.5	C	31.0	C			291	0.69	30.9	C	30.3	C		
			EBR	104								118							
		County St	NBT	364	0.51	7.2	A	7.2	A	14.6	B	413	0.60	9.6	A	9.6	A	17.5	B
			NBR	176								200							
			SBL	50	0.59	10.2	B	10.2	B			57	0.72	16.0	B	16.0	B		
			SBT	418								474							
9	Kempton St/Mill St & Purchase St	Kempton St	EBL	276	1.02	123.8	F					313	1.15	166.4	F				
			EBT	162	0.59	68.4	E	101.5	F			192	0.70	74.1	E	128.4	F		
			EBR	2	0.00	54.6	D					2	0.00	54.6	D				
		Mill St	WBL	352	0.96	105.7	F					406	1.09	142.0	F				
			WBT	161	0.89	90.9	F	91.4	F			183	1.04	123.1	F	119.5	F		
			WBR	94	0.46	60.9	E			82.2	F	115	0.56	64.7	E			114.2	F
		Purchase St	NBL	147	0.54	62.4	E					173	0.64	66.3	E				
			NBT	404	0.64	62.1	E	60.3	E			463	0.74	65.6	E	63.5	E		
			NBR	134	0.15	52.8	D					159	0.22	54.2	D				
			SBL	44								82							
			SBT	457	0.94	85.6	F	85.6	F			538	1.18	159.2	F	159.2	F		
			SBR	60								77							
10	Huttleston Ave & Middle St	Huttleston Ave	EBT	562	0.38	7.3	A	7.3	A			687	0.49	9.3	A	9.3	A		
			EBR	109								136							
			WBL	11	0.34	7.8	A	7.8	A	10.3	B	13	0.43	9.3	A	9.3	A	11.6	B
			WBT	465								545							
		Middle St	NBL	102	0.50	31.5	C	31.5	C			118	0.52	29.9	C	29.9	C		
			NBR	34								39							
11	Huttleston Ave & Main St	Huttleston Ave	EBL	120	0.46	12.1	B					145	0.60	13.4	B				
			EBT	436	0.39	11.1	B	11.3	B			536	0.48	10.1	B	10.8	B		
			EBR	40								46							
			WBL	25	0.56	40.2	D					29	0.64	51.8	D				
			WBT	348	0.42	26.3	C	27.4	C			409	0.57	29.1	C	30.9	C		
			WBR	63						28.6	C	73						30.7	C
		Main St	NBL	74								86							
			NBL	75	0.86	56.2	E	56.2	E			87	0.91	62.6	E	62.6	E		
			NBR	25								29							
			SBL	62								72							
			SBT	93	0.84	51.8	D	51.8	D			108	0.89	56.7	E	56.7	E		
			SBR	54								63							

Appendix F-2: Comparison of Existing and No Build Conditions - PM Peak Hour (4:00 PM to 5:00 PM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
12	Huttleston Ave & Green St	Huttleston Ave	EBL	4								5							
			EBT	488	0.33	6.3	A	6.3	A			596	0.41	9.0	A	9.0	A		
			EBR	33								38							
			WBL	8								9							
			WBT	389	0.26	17.9	B	17.9	B			457	0.31	15.8	B	15.8	B		
			WBR	14						15.3	B	16						15.7	B
		Green St	NBL	44								51							
			NBT	8	0.59	41.3	D	41.3	D			9	0.63	42.1	D	42.1	D		
			NBR	24								28							
			SBL	6								7							
			SBT	5	0.37	42.5	D	42.5	D			6	0.41	42.6	D	42.6	D		
			SBR	3								3							
13	Huttleston Ave & Adams St	Huttleston Ave	EBL	23								27							
			EBT	461	1.00	65.8	E	65.8	E			564	1.36	199.4	F	199.4	F		
			EBR	34								39							
			WBL	8								9							
			WBT	373	0.79	40.1	D	40.1	D			438	1.02	74.7	E	74.7	E		
			WBR	170						51.8	D	197						123.7	F
		Adams St	NBL	30								35							
			NBT	84	0.95	92.9	F	92.9	F			97	1.12	147.2	F	147.2	F		
			NBR	29								34							
			SBL	122								141							
			SBT	72	0.72	19.4	B	19.4	B			83	0.88	39.6	D	39.6	D		
			SBR	8								9							
14	Huttleston Ave & Holcomb St	Huttleston Ave	EBL	31								36							
			EBT	561	0.35	4.0	A	4.0	A			680	0.45	5.5	A	5.5	A		
			EBR	20								23							
			WBL	18								21							
			WBT	485	0.28	3.6	A	3.6	A			568	0.35	4.8	A	4.8	A		
			WBR	3						7.1	A	3						8.0	A
		Holcomb St	NBL	29								34							
			NBT	9	0.48	30.6	C	30.6	C			10	0.46	28.7	C	28.7	C		
			NBR	23								27							
			SBL	13								15							
			SBT	7	0.27	29.4	C	29.4	C			8	0.26	27.5	C	27.5	C		
			SBR	37								43							
15	Huttleston Ave & Bridge St	Bridge St	EBL	8								9							
			EBT	70	0.24	19.4	B	19.4	B			81	0.29	20.9	C	20.9	C		
			EBR	37								43							
			WBL	58								67							
			WBT	120	0.84	35.9	D	35.9	D			139	1.01	71.2	E	71.2	E		
			WBR	239						17.8	B	277						27.8	C
		Huttleston Ave	NBL	14								16							
			NBT	341	0.32	9.4	A	9.4	A			401	0.37	9.7	A	9.7	A		
			NBR	85								98							
			SBL	200								232							
			SBT	400	0.59	11.5	B	11.5	B			494	0.72	14.1	B	14.1	B		
			SBR	3								3							

Appendix F-2: Comparison of Existing and No Build Conditions - PM Peak Hour (4:00 PM to 5:00 PM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
16	Huttleston Ave & Alden Rd	Huttleston Ave	EBL	143	0.73	49.9	D					166	0.84	62.9	E				
			EBT	459	0.63	31.0	C	34.8	C			562	0.89	47.0	D	50.1	D		
			EBR	85								98							
			WBL	97	0.68	54.1	D					112	0.66	49.2	D				
			WBT	396	0.82	45.6	D	46.7	D			465	1.09	107.2	F	99.3	F		
			WBR	180						41.7	D	208						66.4	E
		Alden Rd	NBL	87								101							
			NBT	162	0.69	38.6	D	38.6	D			188	0.74	39.3	D	39.3	D		
			NBR	63								73							
			SBL	240								278							
			SBT	182	0.87	46.2	D	46.2	D			211	0.98	65.0	E	65.0	E		
			SBR	108								125							
17	Huttleston Ave & Route 240	Huttleston Ave	EBL	74	0.26	31.9	C					86	0.37	40.1	D				
			EBT	425	0.45	39.3	D	24.4	C			513	0.62	48.6	D	30.2	C		
			EBR	263	0.21	0.2	A					314	0.24	0.2	A				
		Route 6	WBL	85	0.34	18.5	B					98	0.47	20.5	C				
			WBT	362	0.41	26.0	C	15.1	B			426	0.54	29.9	C	17.3	B		
			WBR	234	0.23	0.4	A			21.9	C	271	0.27	0.5	A			24.1	C
		Route 240	NBL	192	0.61	27.2	C					222	0.60	22.9	C				
			NBT	251	0.68	39.2	D	28.5	C			291	0.70	38.0	D	26.5	C		
			NBR	94	0.07	0.1	A					109	0.08	0.1	A				
			SBL	260	0.64	19.9	B					301	0.72	21.0	C				
			SBT	352	0.52	30.1	C	21.1	C			408	0.62	32.5	C	22.6	C		
			SBR	122	0.09	0.1	A					141	0.10	0.1	A				
18	Bridge St & Alden Rd	Bridge St	EBL	178	0.99	97.3	F					206	1.14	144.5	F				
			EBT	252	0.87	49.5	D	67.8	E			292	1.01	82.1	F	105.9	F		
			EBR	30								35							
			WBL	181	0.98	93.3	F					210	1.13	140.5	F				
			WBT	310	0.88	50.8	D	45.5	D			359	1.02	83.5	F	68.8	E		
			WBR	278	0.24	12.5	B			51.8	D	322	0.28	12.8	B			77.1	E
		Alden Rd	NBL	39	1.01	145.7	F					45	1.17	196.1	F				
			NBT	251	0.95	72.5	E	59.6	E			291	1.10	116.9	F	86.8	F		
			NBR	195	0.16	16.7	B					226	0.19	16.9	B				
			SBL	205	0.98	89.0	F					237	1.14	136.4	F				
			SBT	319	0.72	30.4	C	42.3	D			369	0.84	38.9	D	59.9	E		
			SBR	164	0.14	11.1	B					190	0.16	11.2	B				
19	Bridge St & Route 240	Bridge St	EBL	448	0.94	69.7	E					519	1.11	117.2	F				
			EBT	99	0.95	70.9	E	61.0	E			115	1.12	121.7	F	101.3	F		
			EBR	105	0.12	19.9	B					122	0.16	20.8	C				
			WBL	56	0.41	40.6	D					65	0.48	41.9	D				
			WBT	153	0.98	105.1	F	55.0	D			177	1.15	158.4	F	90.7	F		
			WBR	360	0.38	40.3	D			51.4	D	417	0.87	75.2	E			78.6	E
		Route 240	NBL	89	1.03	149.7	F					103	1.21	207.1	F				
			NBT	445	0.83	44.3	D	57.8	E			515	0.97	66.2	E	83.4	F		
			NBR	25	0.03	22.2	C					29	0.03	22.7	C				
			SBL	107	0.71	50.4	D					124	0.77	54.7	D				
			SBT	573	0.89	48.8	D	41.2	D			663	1.04	82.8	F	57.2	E		
			SBR	527	0.37	32.1	C					610	0.43	33.2	C				

Appendix F-2: Comparison of Existing and No Build Conditions - PM Peak Hour (4:00 PM to 5:00 PM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
20	Union St & Route 18	Union St	EBL	0	0.26	60.2	E	60.2	E			0	0.26	60.2	E	60.2	E		
			EBR	3								3							
		Route 18	NBL	0	0.52	2.1	A	2.1	A	2.4	A	0	0.60	2.6	A	2.6	A	2.9	A
			NBT	1350								1546							
			SBT	1449	0.56	2.4	A	2.4	A			1659	0.64	2.9	A	2.9	A		
			SBR	0								0							
21	Hillman St & Purchase St	Hillman St	WBL	190	0.51	19.5	B	19.5	B			276	0.74	27.1	C	27.1	C		
			WBR	54								74							
		Purchase St	NBT	281	0.35	10.2	B	10.8	B	12.8	B	319	0.40	10.8	B	11.7	B	15.4	B
			NBR	539	0.41	11.1	B					631	0.48	12.1	B				
			SBL	99	0.28	10.1	B	12.7	B			116	0.35	11.2	B	14.2	B		
			SBT	415	0.58	13.4	B					471	0.65	15.0	B				
22	Hillman St & NB JFK Memorial Hwy On Ramp	Hillman St	EBLT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			WBTR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	Purchase St & SB JFK Memorial Hwy Off Ramp	JFK Memorial Hwy Off Ramp	WBL	259	-	57.2	F	57.2	F			294	-	148.5	F	148.5	F		
			WBR	53								60							
		Purchase St	NBT	316	-	0.0	-	0.0	-	18.8	C	371	-	0.0	-	0.0	-	48.0	E
			NBR	0								0							
			SBL	0	-	0.0	-	0.0	-			0	-	0.0	-	0.0	-		
			SBT	314								360							
24	Linden St & County St	Linden St	EBT	67	-	12.5	B	12.5	B			76	-	15.1	C	15.1	C		
			EBR	235								266							
			WBL	54	-	10.8	B	10.8	B	14.3	B	61	-	11.9	B	11.9	B	18.2	C
			WBT	76								86							
		County St	NBL	204	-	16.8	C	16.8	C			231	-	22.9	C	22.9	C		
			NBR	133								151							
25	Washburn St & Belleville Ave	Washburn St	EBL	86								98							
			EBT	96	-	508.0	F	508.0	F			109	-	Err	F	Err	F		
			EBR	10								11							
			WBL	35	-	16.4	C	16.4	C			40	-	31.4	D	31.4	D		
			WBR	572						107.3	F	649						1941.6	F
		Belleville Ave	NBT	4	-	0.0	-	0.0	-			5	-	0.0	-	0.0	-		
			NBR	7								8							
			SBL	288	-	6.0	A	6.0	A			327	-	6.2	A	6.2	A		
			SBT	129								146							
26	Coggeshall St & Mt. Pleasant	Coggeshall St	EBL	15								17							
			EBT	68	-	10.9	B	10.9	B			77	-	12.1	B	12.1	B		
			EBR	14								16							
			WBL	18								20							
			WBT	59	-	10.3	B	10.3	B			80	-	11.5	B	11.5	B		
			WBR	17						12.2	B	19						14.6	B
		Mt. Pleasant	NBL	31								35							
			NBT	208	-	13.4	B	13.4	B			236	-	16.7	C	16.7	C		
			NBR	29								33							
			SBL	14								16							
			SBT	227	-	12.4	B	12.4	B			257	-	14.7	B	14.7	B		
			SBR	7								8							

Appendix F-2: Comparison of Existing and No Build Conditions - PM Peak Hour (4:00 PM to 5:00 PM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
27	Coggeshall St & County St	Coggeshall St	EBL	9								10							
			EBT	90	0.21	10.6	B	10.6	B			102	0.24	10.9	B	10.9	B		
			EBR	11								12							
			WBL	59								67							
			WBT	103	0.32	11.6	B	11.6	B			130	0.39	12.4	B	12.4	B		
			WBR	17						13.1	B	19						14.4	B
		County St	NBL	20								23							
			NBT	246	0.51	13.4	B	13.4	B			279	0.58	14.8	B	14.8	B		
			NBR	41								46							
			SBL	15								17							
			SBT	275	0.57	14.6	B	14.6	B			312	0.65	16.5	B	16.5	B		
			SBR	15								17							
28	Coggeshall St & Purchase St	Coggeshall St	EBL	6								7							
			EBT	130	0.29	16.4	B	16.4	B			148	0.33	17.0	B	17.0	B		
			EBR	10								11							
			WBL	33								37							
			WBT	151	0.57	21.1	C	21.1	C			184	0.70	25.0	C	25.0	C		
			WBR	71						14.7	B	94						20.7	C
		Purchase St	NBL	21								24							
			NBT	338	0.59	10.7	B	10.7	B			391	0.68	12.6	B	12.6	B		
			NBR	83								94							
			SBL	116								133							
			SBT	215	0.70	14.1	B	14.1	B			248	0.89	28.4	C	28.4	C		
			SBR	7								8							
29	Coggeshall St & Ashley Blvd	Coggeshall St	EBT	237	0.54	20.1	C	20.1	C			271	0.62	21.9	C	21.9	C		
			EBR	92								104							
			WBL	163	1.22	143.7	F	143.7	F			185	1.67	339.7	F	339.7	F		
			WBT	219						48.9	D	275						102.0	F
		Ashley Blvd	SBL	93	0.60	16.7	B					106	0.69	18.6	B				
			SBT	645				16.4	B			746				18.2	B		
			SBR	36	0.03	10.9	B					41	0.04	11.0	B				
30	Coggeshall St & Acuschnet Ave	Coggeshall St	EBL	56	0.24	10.9	B	11.8	B			63	0.39	14.3	B	14.5	B		
			EBT	274	0.47	12.0	B					314	0.56	14.6	B				
			WBT	274	0.80	28.9	C	28.9	C			338	1.07	86.3	F	86.3	F		
			WBR	55						19.6	B	80						35.2	D
		Acushnet Ave	NBL	108	0.23	15.1	B	19.1	B			122	0.24	14.5	B	20.0	C		
			NBT	400	0.73	23.1	C					469	0.79	25.3	C				
			NBR	269	0.21	14.9	B					307	0.24	14.5	B				
31	Coggeshall St & N Front St	Coggeshall St	EBL	68								77							
			EBT	427	-	2.3	A	2.3	A			484	-	2.7	A	2.7	A		
			EBR	48								59							
			WBL	66								82							
			WBT	298	-	3.1	A	3.1	A	58.2	F	337	-	4.1	A	4.1	A	180.1	F
			WBR	96								109							
		N. Front Street	NBL	31								80							
			NBT	114	-	305.9	F	305.9	F			133	-	830.0	F	830.0	F		
			NBR	70								89							

Appendix F-2: Comparison of Existing and No Build Conditions - PM Peak Hour (4:00 PM to 5:00 PM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
32	Coggeshall St & Belleville Ave	Coggeshall St	EBL	111	0.33	13.8	B					126	0.38	13.6	B				
			EBT	339	0.76	31.4	C	26.9	C			393	0.79	31.5	C	27.0	C		
			EBR	47								53							
			WBL	171	0.69	20.8	C					194	0.82	29.1	C				
			WBT	304	0.65	26.6	C	23.2	C			349	0.67	26.0	C	25.8	C		
			WBR	93	0.10	19.3	B			28.9	C	105	0.12	18.3	B			56.9	E
		Belleville Ave	NBL	39	0.77	34.8	C					44	1.14	129.1	F				
			NBT	174				27.1	C			197				62.8	E		
			NBR	449	0.48	23.4	C					509	0.67	31.4	C				
			SBL	169								192							
			SBT	199	0.88	40.3	D	40.3	D			226	1.14	115.6	F	115.6	F		
			SBR	116								136							
33	Coggeshall St & I-195 Off Ramp	Coggeshall St	EBL	113	0.29	14.0	B					128	0.35	14.0	B				
			EBT	465	0.75	29.5	C	24.1	C			536	0.87	38.2	D	29.1	C		
			EBR	249	0.28	19.8	B					282	0.36	20.6	C				
			WBL	290	1.05	77.1	E					329	1.35	196.3	F				
			WBT	191	0.60	21.0	C	47.9	D			217	0.71	24.9	C	106.9	F		
			WBR	157						64.3	E	178						97.1	F
		195 Off Ramp	NBL	167	0.50	34.2	C					189	0.57	35.8	D				
			NBT	206	0.96	82.8	F	63.3	E			234	1.10	123.7	F	88.6	F		
			SBL	168	1.10	143.1	F	165.2	F			190	1.25	195.8	F	216.6	F		
			SBR	285	1.41	260.8	F					323	1.60	340.3	F				
34	Howland Rd & Main St	Howland Rd	EBL	43								50							
			EBT	198	1.23	169.2	F	169.2	F			238	1.55	303.2	F	303.2	F		
			EBR	138								160							
			WBL	4								5							
			WBT	213	0.40	10.5	B	10.5	B			247	0.46	12.7	B	12.7	B		
			WBR	3						124.7	F	3						225.6	F
		Main St	NBL	112								130							
			NBT	108	1.28	195.3	F	195.3	F			125	1.70	374.3	F	374.3	F		
			NBR	7								8							
			SBL	0								0							
			SBT	103	0.90	81.3	F	81.3	F			119	1.07	127.8	F	127.8	F		
			SBR	99								115							
35	Howland Rd & Adams St	Howland Rd	EBL	0								0							
			EBT	133	0.30	1.0	A	1.0	A			163	0.36	1.4	A	1.4	A		
			EBR	72								83							
			WBL	7								8							
			WBT	133	0.87	78.5	E	78.5	E			154	1.01	110.3	F	110.3	F		
			WBR	9						39.0	D	10						50.0	D
		Adams St	NBL	87								101							
			NBT	116	0.73	47.1	D	47.1	D			134	0.86	60.0	E	60.0	E		
			NBR	5								6							
			SBL	11								13							
			SBT	79	0.58	46.0	D	46.0	D			91	0.64	48.3	D	48.3	D		
			SBR	0								0							

Appendix F-2: Comparison of Existing and No Build Conditions - PM Peak Hour (4:00 PM to 5:00 PM)

				Existing								No Build							
Int ID	Intersection Name	Link Name	Movement	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS	Volume	v/c ratio	Delay	LOS	Approach Delay	Approach LOS	Int. Delay	Int. LOS
36	Howland Rd & Alden Rd	Howland Rd	EBL	11	-	24.2	C	24.2	C	5.6	A	13	-	142.3	F	142.3	F	24.0	C
			EBT	0								9							
			EBR	131								152							
		Nancy St	WBL	4	-	43.4	E	43.4	E			5	-	113.9	F	113.9	F		
			WBT	1								1							
			WBR	5								6							
		Alden Rd	NBL	134	-	3.8	A	3.8	A			155	-	4.6	A	4.6	A		
			NBT	474								549							
			NBR	7								8							
			SBL	4	-	0.3	A	0.3	A			5	-	0.3	A	0.3	A		
			SBT	397								460							
			SBR	23								27							

Legend			
LOS	Mid LOS D	E	F
Delay (Signalized)	45 - 55	55 - 80	>80
Delay (Unsignalized)	30 - 35	35 - 50	>50

Appendix G
Public Comments on Draft Report

The following comments were received on the Draft Report that was circulated for review between August 17, 2015 and September 18, 2015. Responses to each comment are provided below.

COMMENT 1

August 17, 2015
Former local resident:

Today I am emailing you my comments to be added to the public record on the New Bedford-Fairhaven Bridge Corridor (Draft Study). All though I no longer live in Massachusetts due to my current employer and me being promoted to a higher position, I have been following the project to date along with my family. Upon reviewing the Draft Study, I would like to formally recommend Alternative 2W in place of the listed alternatives. My second choice would be Alternative 3W. I recommend these two choices because they allow maximum clearance for ships and these designs traditionally last longer.

As a recommendation for further analysis when ship traffic rebounds, I recommend a second Bascule Bridge in place of West bridge and implementing two one way channels; one on either side of Popes Island.

RESPONSE: Thank you for your input on the recommended bridge alternatives. The next phase in the project development and design process would include the completion of additional analysis of these two alternatives. A Bridge Type Study would be conducted to assess the design feasibility and costs of the two recommended bridge alternatives. A U.S. Coast Guard Navigational Evaluation would also be completed to determine the ability of the recommended bridge alternatives to meet current and future navigational needs concerning horizontal and vertical clearances.

COMMENT 2

August 17, 2015
Dave Janik, South Coastal Regional Coordinator, Massachusetts Office of Coastal Zone Management:

I quickly scanned the MDOT Bridge Study document. CZM may provide more detailed comments at a future date, but for right now I wanted to let you know that on page 5-18 the document references a New Bedford/Fairhaven Municipal Harbor Plan completed in 2002, and the Bridge Corridor Study recommends "that the City of New Bedford initiate a master planning process for the development of the harbor and New Bedford-Fairhaven Bridge study area." The 2002 Municipal Harbor Plan was the first State-Approved Harbor Plan for the area. Subsequently, an updated New Bedford/Fairhaven Municipal Harbor Plan was completed and approved in 2010. The 2010 plan is the one currently in effect.

RESPONSE: Thank you for your comment. Both the 2002 and 2010 New Bedford/Fairhaven Municipal Harbor Plans were used as references in conducting the study. As noted, the reference on page 5-18 was incorrect as it cited only the 2002 study. The date in Chapter 5 will be revised to the most recent 2010 Harbor Plan.

COMMENT 3

August 17, 2015
New Bedford resident:

When will it be completed?

RESPONSE: This study represents the beginning two steps in MassDOT's eight step project development and design process. The study will conclude on September 30, 2015. The next steps are dependent on funding. It is anticipated that the project could proceed into the project initiation and environmental permitting, design, and right-of-way process in the next year. Completion of a new bridge would take at least 10 or more years for design, permitting, programming, procurement, and construction.

COMMENT 4

August 18, 2015
Mary Rapoza, Director of New Bedford Parks Recreation & Beaches:

I am so pleased that I was able to participate in this thoughtful and thorough review of the needs along this corridor. Thank you for seriously considering the identified recreational and multi modal needs of the corridor. At the end of the process, I have to give my vote to the ALTERNATIVE 3W: WIDE DOUBLE-LEAF ROLLING BASCULE BRIDGE as the most feasible although it is definitely not the most aesthetic it does address most of the concerns.

RESPONSE: Thank you for your input on the recommended bridge alternatives. The next phase in the project development and design process would include the completion of additional analysis of the two recommended alternatives. A Bridge Type Study would be conducted to assess the design feasibility and costs of the two recommended bridge alternatives. A U.S. Coast Guard Navigational Evaluation would also be completed to determine the ability of the recommended bridge alternatives to meet current and future navigational needs concerning horizontal and vertical clearances.

Some general comments:

- Impacts to air quality and greenhouse gases from idling vehicles. We didn't spend much time discussing this issue. I was under the impression that there is a limit to the number of minutes a vehicle can legally idle in Mass. If this is so can we have signs letting motorists know to turn off their engines?
  RESPONSE: Encouraging the reduction of vehicle idling is beneficial to local and regional air quality and consistent with the policies of MassDOT. In the context of the queues at the New Bedford-Fairhaven Bridge, installing signs requesting motorists turn off their vehicles at the bridge would need to be investigated further to assess any legal or safety issues. This will be included as a new recommended short-term action in the report.
- Community Impacts. I am concerned that there is no mention of Fairhaven High School in community needs. The students cross Route 6 at Park Avenue to access the school's athletic fields at Cushman Park. Consideration should be made for that safety concern.

RESPONSE: In 2013, significant improvements were made to the pedestrian environment, including sidewalks and crosswalks along Route 6 in Fairhaven. Although it was noted in study meetings that students cross Route 6 at that location, no specific safety concerns have been identified either through the data collection effort or by local safety personnel.

- In the report, it states, "A pedestrian path that provides a more direct path for pedestrians between the "Octopus Intersection" and the Route 18/Elm Street intersection is proposed for the corridor." Thank you for addressing the concerns of pedestrians and bicyclists.

In the report, it states "However, even though Alternative 2 provides additional pedestrian and bicycle facilities, high pedestrian or bicycle volumes are not seen on the bridge and are not anticipated in the future. Alternative 2 will have no impact to high volume bicycle or pedestrian locations." The Mayor hopes that improvements to access will indeed increase pedestrian access from the Marina to downtown New Bedford.

September 8, 2015 - Second set of comments:

We are concerned that the attached plan [2014 signage and striping plan for current MassDOT roadway project] does not show a sidewalk across Route 6 from the Marina/park to the businesses on the north side. We need to add a strong visual crosswalk preferably in line with the Marina building entrance across Route 6 to the north.

I have included some of the relevant sections from the bridge corridor study.

Bicycle and Pedestrian Improvements. The following bicycle or pedestrian improvements could commence as soon as the ongoing roadway construction projects are completed in late 2015:

- Bicycle and pedestrian path along Route 6 from Pleasant Street to Route 18;
- New pedestrian ramp and staircase between Route 6 and MacArthur Drive; and
- Completion of sidewalk network along MacArthur Drive.

3.1.7 Bicycle/Pedestrian Facilities

The New Bedford-Fairhaven Bridge is the only pedestrian or bicycle access point between downtown Fairhaven and New Bedford. Pedestrians can use a sidewalk on either side of the travel lanes, but there is only one crosswalk between the New Bedford and Fairhaven shores. Pedestrian access to the bridge from New Bedford is limited to a new pedestrian ramp down to JFK Memorial Highway. A staircase on the north side of the travel lanes was closed in the last two years as part of the most recent roadway construction project. Pedestrians and bicyclists are prohibited on Route 6 ramps between Purchase Street and MacArthur Drive. The primary concern along the bridge is the lack of crosswalks. A single crosswalk on Pope's Island provides a safe crossing point for pedestrians between the New Bedford and Fairhaven shorelines.

4.10.2 Based on the assessment of bicycle and pedestrian conditions along the corridor, three potential improvements have been identified. As shown in Figure 4.8, these improvements include:

- A bicycle and pedestrian path along Route 6 from Pleasant Street to Route 18;

- A pedestrian ramp and staircase to replace staircase on north side of bridge; and
- Completion of sidewalk network along MacArthur Drive, which is the primary pedestrian route from the bridge to the proposed Whale's Tooth Commuter Rail Station.

RESPONSE: The 2014 signage and striping plan for the current repair project did not include permanent installation of the crosswalk on Pope's Island. This referenced crosswalk was originally installed in 2012 in order to provide pedestrian continuity during the construction project. In light of the importance of pedestrian connectivity along the corridor, MassDOT is evaluating the crosswalk and additional safety features at this location, including a potential High Intensity Activated Crosswalk (HAWK) beacon. The completion of the enhanced crosswalk or evaluation of other options will be added as a new short-term recommendation of this study.

COMMENT 5

August 18, 2015
Livable Streets Alliance:

I have a few quick questions about the Draft Study Report for the New Bedford-Fairhaven Bridge. I read the report, in particular all the sections about improving pedestrian and bicycle access through the project area. I was wondering if you could clarify the following for me regarding navigating around the stretch of Route 6 where bicycles and pedestrians are prohibited:

1. When proceeding on bike along Route 6 starting at the Pleasant St (Octopus) intersection heading east, what is the intended route for bicyclists to get to the bridge? Once they get to the bridge, are they expected to ride on the sidewalk or will there be a way to access the roadway shoulders as well?

RESPONSE: Bicycle access to the bridge from the west is not anticipated to be modified from the configuration that was completed in 2013. The reconstruction of Route 18, MacArthur Drive, and the ramp connecting northbound Route 18 with eastbound Route 6 included the construction of a wide sidewalk that can be used by both pedestrians and bicyclists to connect to Fish Island. At Fish Island, bicyclists ride along the shoulders or continue along the sidewalk depending upon their preference.

2. When proceeding on bike along Route 6 on the bridge heading west, riding in the roadway, what is the intended route for bicyclists to get to the Pleasant St (Octopus) intersection?

RESPONSE: With the completion of all improvements recommended in the plan, westbound bicyclists will be able to use the new ramp structure on the north side of the roadway to access MacArthur Drive. From MacArthur Drive, bicyclists can utilize the recently completed extension of Elm Street to then access the multiuse path recommended in the study that would connect Elm Street/Route 18 to Pleasant Street.

3. Was any consideration given to eliminating the bicycle/pedestrian prohibition on Route 6 through the Route 18 interchange and installing sidewalks/crosswalks and bike lanes along there (by either widening the roadway structures or dropping a lane)? It seems like this would be a much more direct connection than any of the current proposals.

RESPONSE: Consideration was given to alternative routes to provide connections between Pleasant Street and the bridge. The combination of the multi-use path and the ramp structures was thought to provide the best and safest connections. Modifications to the interchange ramps was not considered a viable option since the design that includes high speed merging and diverging traffic could not be effectively modified and allow for the safe use of the ramp structures by bicyclists.

COMMENT 6

August 19, 2015
Marion resident:

The continued maintenance of the existing New Bedford-Fairhaven swing bridge and repair of the bridge superstructure in the same configuration as currently exists is not an option due to constant bridge malfunction, cost of repairs, safety, transportation impact and economic development.

When planning for the future, a taller Vertical Lift Bridge connecting New Bedford and Fairhaven could provide an air draft of 150 feet and a navigational channel width of up to 270 feet. Construction duration of 33 months would not be a greater hardship than what is presently endured every few years for swing bridge repairs, maintenance, and lane closures, after which, we still have an obsolete structure.

Some might consider a new Vertical Lift Bridge estimated to cost $100-130 million an expensive project, but in the long run, a new bridge would offer many benefits, for example, decrease annual operating and maintenance costs saving both time and money, increase vehicular and pedestrian safety, improve navigation and enhance economic development by making the Port of New Bedford more attractive as a destination for large fishing and cargo vessels.

Other areas for improvement:

1. Alleviate existing corridor congestion by adjusting signal timing and lane configuration in the corridor at Kempton Street/Mill Street and Purchase Street and at Huttleston Avenue/Main Street.
2. Make improvements to accommodate future corridor congestion on existing Fairhaven bridge detour routes at Bridge Street and Route 240, Howland Road and Main Street and on Coggeshall Street in New Bedford at the intersections of Ashley Boulevard, Front Street, Belleville Avenue, and the I-95 off ramp.
3. Identify alternative routes and/or improve Intelligent Transportation Systems such as timely warning signs to motorists that the bridge is closed or will soon close to vehicular traffic, which would allow motorists to take an alternate route.

4. Improve corridor pedestrian/bicycle facilities by (a) segregating these uses onto separate sidewalks; (b) reducing the number of vehicle lanes to permit the addition of bicycle lanes; (c) creating new pedestrian connections between New Bedford and Fairhaven; and (d) improve pedestrian connections between downtown New Bedford, Route 6 bridge and the future Whale's Tooth Commuter Rail Station.

RESPONSE: Thank you for your input on the recommended bridge alternatives. The next phase in the project development and design process would include the completion of additional analysis of these two alternatives, with the goal providing more analysis to allow selection of one build alternative. A Bridge Type Study would be conducted to assess the design feasibility and costs of the two recommended bridge alternatives. A U.S. Coast Guard Navigational Evaluation would also be completed to determine the ability of the recommended bridge alternatives to meet current and future navigational needs concerning horizontal and vertical clearances.

Signal timing changes are recommended as part of the short-term recommendations from the study at Kempton Street/Mill Street and Purchase Street or Huttleston Avenue and Main Street. It is anticipated that these changes will be completed by MassDOT, the City of New Bedford, or the Town of Fairhaven as traffic volumes warrant. As part of another effort, intersection improvements, including pedestrian improvements, lighting, new walk signals, brick islands, and landscaping at Kempton Street/Mill Street and Purchase Street will be completed by the end of 2015.

No lane configuration changes are recommended in the short term beyond the anticipated MassDOT striping that will be completed as part of the current bridge maintenance project. The study concluded that reduced vehicular lanes to accommodate a bicycle lane would not work. The existing bridge right-of-way width limits the ability to reduce lane width and add in a bicycle lane. As part of a long-term bridge replacement project, a new bridge would be designed with a 64-foot-wide ROW, which would allow four 11-foot-wide vehicular travel lanes, two five-foot-wide bike lanes, and two five-foot-wide sidewalks. Pedestrian and bicycle improvements are proposed in New Bedford to accommodate movement between Kempton Street/Mill Street and Purchase Street intersection, the future Whale's Tooth Commuter Rail Station, and the Route 6 bridge.

Short and medium-term ITS improvements proposed for the study area are recommended to alleviate the existing and anticipated congestion and delay along the Route 6 corridor.

COMMENT 7

August 20, 2015
Local resident:

Who is funding the project? If individual nearby towns, please provide funding by town.

RESPONSE: A funding plan for the project has not been developed at this stage of project development. Since the bridge is owned by MassDOT and is along a state highway, the funding plan will be led by MassDOT. Major bridge projects such as this one are typically principally funded through a combination of state and federal sources and any local municipal funding is for upgrades requested by the municipality.

COMMENT 8

August 20, 2015
New Bedford business owner (AGM Marine Contractors):

We would like to clarify one item within the draft report. Within Chapter 4, there is a subsection within each of the alternative that discusses Impact to Business Access. Within this subsection, the report lists parcels around the middle bridge that could potentially be impacted by the alternative. Tucker Roy Marine Towing & Salvage is listed as a business that could be impacted; Tucker Roy is a tenant on the South side of Fish Island but their operation is confined to a smaller area on the South side of Fish Island. AGM Marine Contractors, Inc. is the main tenant and user of the South side of Fish Island (the parcel behind the gas station) with its operation extensively utilizing the parcel. AGM is the business that could potentially be the most disrupted or impacted by any of the listed bridge alternatives.

RESPONSE: Thank you for your comment. The referenced sections in Chapter 4 will be updated to include AGM Marine Contractors, Inc. as a business that could have impacts to access.

COMMENT 9

August 21, 2015
New Bedford resident:

I was reading the article in the New Bedford Standard-Times regarding the design of the new bridge. It stated to submit our opinions. Well, my husband and I both agree that if they are going to build a new bridge that it should be the Vertical Bridge.

Why would you want to spend the money on the Bascule Bridge? It will not give you the amount of clearance that the Vertical Bridge would give you. If you are going to spend the money and time on replacing the bridge you might as well spend a little bit more and get the bridge that will work best for the New Bedford Harbor.

You know that if the Bascule Bridge gets voted in, they will no sooner be done building it and then they will find out that there will not be enough clearance to accommodate the larger ships that we are hoping to do business in our port.

This is just our opinion. Hopefully, it will help you decide which bridge would be best for the New Bedford Harbor.

RESPONSE: Thank you for your input on the recommended bridge alternatives. The next phase in the project development and design process would include the completion of additional analysis of the Vertical Lift Bridge and the Double-Leaf Dutch-Style Bridge alternatives. A Bridge Type Study would be conducted to assess the design feasibility and costs of the two alternatives. Additionally a U.S. Coast Guard Navigational Evaluation would also be completed to determine the ability of the recommended bridge alternatives to meet current and future navigational needs concerning horizontal and vertical clearances.

COMMENT 10

August 26, 2015
Local resident:

Fix the bridge light on Purchase Street.

RESPONSE: The following signal-related intersection improvements are recommended for the Kempton Street/Mill Street and Purchase Street intersection.

From Section 4:10.1, Route 6 and Pleasant Street: "The proposed signal timing will combine north and south traffic movements into one concurrent phase. The same would be true for east and west traffic movements. In addition, the exclusive pedestrian phase would be distributed among the concurrent phases to operate in conjunction with each non-opposing signal phase. This results in a reduced cycle length of 120 seconds, thus optimizing the operations at the intersection as well as reducing the delays on all approaches."

COMMENT 11

September 1, 2015
New Bedford resident:

Nothing in the article in the New Bedford Standard-Times "Choices Down to Two for New Bedford-Fairhaven Bridge" (8/19/15) persuades me that either of the two new bridge options is a viable one. According to this article, the "new bridge would not decrease the wait for vehicle traffic," yet it is the current "wait" that bothers most drivers. Indeed, a new bridge may not be needed at all. According to a draft report of the New Bedford-Fairhaven Bridge Corridor Study to which this article refers, because of the width of the opening that the current bridge provides boats, the "existing swing span has been cited as an issue that *may be* [my italics] limiting port activity.'" Mayor Mitchell is noted as having said that "widening the channel . . . *would* [my italics] boost the economy." There's a big difference in likelihood between "`may'" and "would." Before being subjected to the time ("33 months for construction"--that is, almost 3 years] and expense [between $100-$130 million in "capital costs"] that replacing the current bridge would apparently require, let us first have credible evidence that a new bridge *will*--not "`may'"--be advantageous to our community. Until then, tell our leaders to order the repair of the "mechanical problems that periodically affect the [current] bridge" that engineers have said exist.

RESPONSE: As stated in the plan, "Due to the age of some original structural components and the fatigue and stresses that are put on the bridge members on a regular basis, options for replacing the entire swing truss section of the bridge need to be considered. At 120 years, the swing truss section is showing signs that it is beyond its useful life and will need to be replaced. It is estimated that this will need to occur within the next 15 to 20 years." The No Build Alternative, which included the continued repair and maintenance of the existing swing span and bridge structure in its current configuration, is estimated to cost at least $45 million. Based on past inspections and maintenance requirements over the last decade, it is assumed that a full replacement of the superstructure will be required within the next fifteen years.

Analysis completed as part of this study is preliminary in nature and additional analysis would be required to move the project forward. The next steps in the project development and design process would be to undertake a Bridge Type Study to assess the design feasibility and costs of the two recommended bridge alternatives. A U.S. Coast Guard Navigational Evaluation would also be completed to determine the ability of the recommended bridge alternatives to meet current and future navigational needs concerning horizontal and vertical clearances.

COMMENT 12

September 6, 2015
Ed Anthes-Washburn, Acting Port Director of New Bedford Harbor Development Commission (HDC):

One thing I'd like to comment on is the SER process described on pages 5.19 and 5.20.

Because the SER process is tied to the Superfund Cleanup, it may not be available after the EPA completes their cleanup. While the EPA will have significantly lowered the levels of PCBs in the harbor, they will not touch any material below 50ppm and that sediment will remain. This material is not suitable for offshore disposal. If the bridge project is completed after the EPA leaves NB Harbor and discontinues the SER process of placing impacted sediments in Confined Aquatic Disposal Cells (CAD Cells) then it must be removed and placed in upland Toxic Substances Control Act (TSCA)-approved and monitored landfills.

The cost of upland disposal is much higher- a factor of 10 the last time we investigated. The cost of placing the material in a CAD cell is around $60/CY versus $600/CY for upland disposal (I've cc'd Apex to provide more backup information as they have the bid costs available). The cost difference could be significant when dredging the area where the current bridge sits, as either recommended alternative will require. If there is 5,000-10,000CY of impacted sediment for the project the cost of disposal goes from $300,000-$600,000 to $3,000,000 to $6,000,000. This is significant, and getting this project on the current list of dredging projects should be seen as a priority before the EPA completes their cleanup.

Thank you for your attention on this important detail. The HDC is happy to work with MassDOT to ensure this project gets on the Phase V dredging list.

RESPONSE: It is noted that utilizing the on-going SER process and the existing CAD cells for disposal of contaminated sediment would present a significant cost savings to the project, somewhere on the order of $5 million. The ability of any project to realize those savings would depend upon the project development process duration. As noted, it is typical for projects to take six to eight years to proceed through design and permitting. To the greatest extent possible given the typical project development timeframe, MassDOT would work to leverage the cost savings that could be achieved by utilizing the ongoing EPA cleanup activities. As any project is advanced through design, the potential cost savings opportunity would be incorporated into the project schedule evaluation.

COMMENT 13

September 18, 2015
William M. Straus, State Representative 10th Bristol District
Antonio F.D. Cabral, State Representative 13th Bristol District

We write with respect to the Draft New Bedford-Fairhaven Bridge Corridor Study report. We believe the project will provide significant improvements to the region and surrounding businesses, and we fully support the shore-, medium-, and long-term recommendations outlined in the report.

Variable messaging boards, intersection improvements, and bicycle/pedestrian improvements will increase vehicular and pedestrian safety, provide for better functionality of the corridor, and increase connectivity for all users.

Further, a replacement bridge is absolutely necessary. The current bridge is functionally obsolete, has long outlived its useful design life, and will require extensive ongoing maintenance. Moreover, replacing the existing structure will allow for reconfiguration of this narrow chokepoint and foster increased operability for the Port of New Bedford.

We note, however, that although both the Tall Vertical Lift Bridge and Double-Left Dutch Bascule Bridge options may have merit, due to the estimated 3-month road closure, impact to harbor operations from maintaining only one navigational channel, and unknown long-term reliability of the Double-Leaf Bascule alternative, we strongly recommend advancement of the Tall Vertical Lift Bridge option.

Thank you very much for your time and consideration.

RESPONSE: Thank you for both your time and participation in the study process. As you stated, there are multiple benefits to proceeding with the replacement of the existing swing span. We appreciate and understand your opinion regarding the recommended bridge option and it will be factored into the next phase of the project. During this next phase, additional detail would be developed to support a final evaluation of the two options and potential selection of one bridge type.

NEW BEDFORD-FAIRHAVEN BRIDGE
CORRIDOR STUDY

PUBLIC COMMENTS (EMAILS AND LETTERS)

COMMENT 1 (EMAIL)

From: George Chambers <ghchambers@ualr.edu>
Sent: Monday, August 17, 2015 8:39 PM
To: Weston, John
Subject: New Bedford-Fairhaven Bridge Corridor (Draft Study) Comments

Hello John Weston, Today I am emailing you my comments to be added to the public record on the New Bedford-Fairhaven Bridge Corridor (Draft Study). All though I no longer live in Massachusetts due to my current employer and me being promoted to a higher position, I have been following the project to date along with my family. Upon reviewing the Draft Study, I would like to formally recommend Alternative 2W in place of the listed alternatives. My second choice would be Alternative 3W. I recommend these two choices because they allow maximum clearance for ships and these designs traditionally last longer.

As a recommendation for further analysis when ship traffic rebounds, I recommend a second Bascule Bridge in place of West bridge and implementing two one way channels; one on either side of Popes Island.

Kind regards,

Mr. George H. Chambers III

COMMENT 2 (EMAIL)

From: Janik, David (DEP) <david.janik@state.ma.us>
Sent: Monday, August 17, 2015 3:49 PM
To: Weston, John
Cc: Washburn, Bradford (ENV)
Subject: New Bedford/Fairhaven Bridge Corridor Study

Hello John,
I quickly scanned the MDOT Bridge Study document. CZM may provide more detailed comments at a future date, but for right now I wanted to let you know that on page 5-18 the document references a New Bedford/Fairhaven Municipal Harbor Plan completed in 2002, and the Bridge Corridor Study recommends "that the City of New Bedford initiate a master planning process for the development of the harbor and New Bedford-Fairhaven Bridge study area." The 2002 Municipal Harbor Plan was the first State-Approved Harbor Plan for the area. Subsequently, an updated New Bedford/Fairhaven Municipal Harbor Plan was completed and approved in 2010. The 2010 plan is the one currently in effect.
Do not hesitate to call me if you have any follow-up questions.
Regards,
Dave Janik
South Coastal Regional Coordinator
Office of Coastal Zone Management
508-291-3625 ext 12

COMMENT 3(EMAIL)

From:	Rednebd8@aol.com
Sent:	Monday, August 17, 2015 3:07 PM
To:	Weston, John
Subject:	(no subject)

Hello..Dave Bender here...live in New Bedford and wondered when it will be completed.? Thanks
rednebd8@aol.com

COMMENT 4 (EMAIL)

From:	Mary S. Rapoza <Mary.Rapoza@newbedford-ma.gov>
Sent:	Tuesday, August 18, 2015 4:11 PM
To:	Weston, John
Subject:	Mass DOT New Bedford-Fairhaven Bridge Working Group Update

HI John,

I am so pleased that I was able to participate in this thoughtful and thorough review of the needs along this corridor. Thank you for seriously considering the identified recreational and multi modal needs of the corridor. At the end of the process I have to give my vote to the ALTERNATIVE 3W: WIDE DOUBLE-LEAF ROLLING BASCULE BRIDGE as the most feasible although it is definitely not the most aesthetic it does address most of the concerns.

Some general comments.

IMPACTS TO AIR QUALITY AND GREENHOUSE GASES FROM IDLING VEHICLES We didn't spend much time discussing this issue. I was under the impression that there is a limit to the number of minutes a vehicle can legally idle in Mass. If this is so can we have signs letting motorists know to turn off their engines?

Community Impacts I am concerned that there is no mention of Fairhaven High School in community needs. The students cross Rte 6 at Park Ave to access the school's athletic fields at Cushman Park. Consideration should be made for that safety concern.

A pedestrian path that provides a more direct path for pedestrians between the "Octopus Intersection" and the Route 18/Elm Street intersection is proposed for the corridor. Thank you for addressing the concerns of pedestrians and bicyclists.
However, even though Alternative 2 provides additional pedestrian and bicycle facilities, high pedestrian or bicycle volumes are not seen on the bridge and are not anticipated in the future. Alternative 2 will have no impact to high volume bicycle or pedestrian locations. The Mayor hopes that improvements to access will indeed increase pedestrian access from the Marina to downtown New Bedford.

Best,
Mary

Mary S. Rapoza, Director
New Bedford Parks Recreation & Beaches
181 Hillman St., Building 3
New Bedford, MA 02740
Phone: 508-961-3015
Fax: 508-991-6175

From: Mary S. Rapoza <Mary.Rapoza@newbedford-ma.gov>
Sent: Tuesday, September 08, 2015 11:42 AM
To: Larry Gordon; Weston, John
Cc: Donna L. Roderiques; Edward Anthes-Washburn
Subject: FW: Emailing - 20150710152248949.pdf
Attachments: 20150710152248949.pdf

HI Larry and John,

We are concerned that the attached plan does not show a sidewalk across Rte 6 from the Marina/park to the businesses on the north side. We need to add a strong visual crosswalk preferably in line with the Marina building entrance across Rte 6 to the north.

Thank you for your consideration of this matter. I have included some of the relevant sections form the bridge corridor study.

Best,
Mary

NEW BEDFORD-FAIRHAVEN BRIDGE
CORRIDOR STUDY

Bicycle and Pedestrian Improvements. The following bicycle or pedestrian improvements could commence as soon as the ongoing roadway construction projects are completed in late 2015: o Bicycle and pedestrian path along Route 6 from Pleasant Street to Route 18;

- New pedestrian ramp and staircase between Route 6 and MacArthur Drive; and
- Completion of sidewalk network along MacArthur Drive.

3.1.7 Bicycle/Pedestrian Facilities

The New Bedford-Fairhaven Bridge is the only pedestrian or bicycle access point between downtown Fairhaven and New Bedford. Pedestrians can use a sidewalk on either side of the travel lanes, but there is only one crosswalk between the New Bedford and Fairhaven shores. Pedestrian access to the bridge from New Bedford is limited to a new pedestrian ramp down to JFK Memorial Highway. A staircase on the north side of the travel lanes was closed in the last two years as part of the most recent roadway construction project. Pedestrians and bicyclists are prohibited on Route 6 ramps between Purchase Street and MacArthur Drive. The primary concern along the bridge is the lack of crosswalks. A single crosswalk on Pope's Island provides a safe crossing point for pedestrians between the New Bedford and Fairhaven shorelines.

● 4.10.2 Based on the assessment of bicycle and pedestrian conditions along the corridor, three potential improvements have been identified. As shown in Figure 4.8, these improvements include: • A bicycle and pedestrian path along Route 6 from Pleasant Street to Route 18; • A pedestrian ramp and staircase to replace staircase on north side of bridge; and • Completion of sidewalk network along MacArthur Drive, which is the primary pedestrian route from the bridge to the proposed Whale's Tooth Commuter Rail Station.

Mary S. Rapoza, Director
New Bedford Parks Recreation & Beaches
181 Hillman St., Building 3
New Bedford, MA 02740
Phone: 508-961-3015
Fax: 508-991-6175

From: Donna L. Roderiques
Sent: Tuesday, September 08, 2015 9:46 AM
To: Mary S. Rapoza
Cc: Edward Anthes-Washburn
Subject: FW: Emailing - 20150710152248949.pdf

Hi Mary,
Are you aware there is no crosswalk in the Route 6 plan in front of Pope's Island Park? Can this be amended?
Best,
Donna

Donna L. Roderiques, CPA
Director, Administration & Finance
Port of New Bedford
Harbor Development Commission
52 Fisherman's Wharf, New Bedford, MA 02740
Office: (508) 961-3000
Donna.Roderiques@newbedford-ma.gov
www.portofnewbedford.org

From: Larry Gordon [mailto:lgordon@middlesexco.com]
Sent: Friday, July 10, 2015 3:04 PM
To: Donna L. Roderiques
Subject: Emailing - 20150710152248949.pdf

Hi Donna, Here is the final roadway layout for the project. This was revised from original plan. 4/11 ft lanes and two 4 ft shoulders. No crosswalks in our scope. Enjoy your boating and talk next week.

Best

Larry Gordon/TMC

Larry Gordon
The Middlesex Corporation
Project Superintendent
One Spectacle Pond Rd.
Littleton, MA 01460
Office: 508-726-2605
Fax:
Mobile: 508-726-2605

COMMENT 5 (EMAIL)

From: Charlie Denison <charlie@livablestreets.info>
Sent: Tuesday, August 18, 2015 12:33 AM
To: Weston, John
Subject: New Bedford-Fairhaven Bridge -- A few quick questions

Hello Mr. Weston,

I have a few quick questions about the Draft Study Report for the New Bedford-Fairhaven Bridge. I read through the report, in particular all the sections about improving pedestrian and bicycle access through the project area. I was wondering if you could clarify the following for me regarding navigating around the stretch of Route 6 where bicycles and pedestrians are prohibited:

1. When proceeding on bike along Route 6 starting at the Pleasant St (Octopus) intersection heading east, what is the intended route for bicyclists to get to the bridge? Once they get to the bridge, are they expected to ride on the sidewalk or will there be a way to access the roadway shoulders as well?

2. When proceeding on bike along Route 6 on the bridge heading west, riding in the roadway, what is the intended route for bicyclists to get to the Pleasant St (Octopus) intersection?

3. Was any consideration given to eliminating the bicycle/pedestrian prohibition on Route 6 through the Route 18 interchange and installing sidewalks/crosswalks and bike lanes along there (either by widening the roadway structures or dropping a lane)? It seems like this would be a much more direct connection than any of the current proposals.

Thank you.

Charlie Denison
Advocacy Committee Chair
LivableStreets Alliance

COMMENT 6 (EMAIL)

From: Eileen Marum <u_emarum@umassd.edu>
Sent: Wednesday, August 19, 2015 11:33 AM
To: Weston, John
Subject: Public Comment New Bedford--Fairhaven Bridge

Eileen Marum
41 Mill Street
Marion, MA 02738
u_emarum@umassd.edu

508-748-1282

Dear Mr. Weston,

The continued maintenance of the existing New Bedford-Fairhaven swing bridge and repair of the bridge superstructure in the same configuration as currently exists is not an option due to constant bridge malfunction, cost of repairs, safety, transportation impact and economic development.

When planning for the future, a taller Vertical Lift Bridge connecting New Bedford and Fairhaven could provide an air draft of 150 feet and a navigational channel width of up to 270 feet. Construction duration of 33 months would not be a greater hardship than what is presently endured every few years for swing bridge repairs, maintenance and lane closures, after which, we still have an obsolete structure.

Some might consider a new Vertical Lift Bridge estimated to cost $100-130 million an expensive project, but in the long run, a new bridge would offer many benefits, for example, decrease annual operating and maintenance costs saving both time and money, increase vehicular and pedestrian safety, improve navigation and enhance economic development by making the Port of New Bedford more attractive as a destination for large fishing and cargo vessels.

Other areas for improvement:

1. Alleviate existing corridor congestion by adjusting signal timing and lane configuration in the corridor at Kempton Street/Mill Street and Purchase Street and at Huttleston Avenue/Main Street.

2. Make improvements to accommodate future corridor congestion on existing Fairhaven bridge detour routes at Bridge Street and Route 240, Howland Road and Main Street and on Coggeshall Street in New Bedford at the intersections of Ashley Boulevard, Front Street, Belleville Avenue and the I-95 off ramp.

3. Identify alternative routes and/or improve Intelligent Transportation Systems such as timely warning signs to motorists that the bridge is closed or will soon close to vehicular traffic, which would allow motorists to take an alternate route.

4. Improve corridor pedestrian/bicycle facilities by (a) segregating these uses onto separate sidewalks; (b) reducing the number of vehicle lanes to permit the addition of bicycle lanes; (c) creating new pedestrian connections between New Bedford and Fairhaven; and (d) improve pedestrian connections between downtown New Bedford, Route 6 bridge and the future Whale's Tooth Commuter Rail Station.

COMMENT 7(EMAIL)

From: Joseph Szaro [mailto:jszaro54@gmail.com]
Sent: Thursday, August 20, 2015 3:34 PM
To: Jill Barrett
Subject: Bridge Funding

Hi Jill,

One question. Who is funding this project? If individual nearby towns, please provide funding by town.

Thank you,

Joseph P. Szaro

COMMENT 8 (EMAIL)

From: Jonah Mikutowicz <jonah.mikutowicz@agmmarine.com>
Sent: Thursday, August 20, 2015 8:27 AM
To: Weston, John
Subject: New Bedford - Fairhaven Bridge Draft Report

John:

We would like to clarify one item within the draft report. Within Chapter 4, there is a subsection within each of the alternative that discusses Impact to Business Access. Within this subsection, the report lists parcels around the middle bridge that could potentially be impacted by the alternative. Tucker Roy Marine Towing & Salvage is listed as a business that could be impacted; Tucker Roy is a tenant on the South side of Fish Island but their operation is confined to a smaller area on the South side of Fish Island. AGM Marine Contractors, Inc. is the main tenant and user of the South side of Fish Island (the parcel behind the gas station) with its operation extensively utilizing the parcel. AGM is the business that could potentially be the most disrupted or impacted by any of the listed bridge alternatives.

Jonah Mikutowicz
AGM Marine Contractors, Inc.
30 Echo Road | Mashpee, MA 02649
p: 508.477.8801 | f: 508.477.8804 | m: 508.776.9759

COMMENT 9 (EMAIL)

From: James N Besse <jbessefamily@verizon.net>
Sent: Friday, August 21, 2015 9:46 PM
To: Weston, John
Subject: Fairhaven Bridge

I was reading the article in the New Bedford Standard-Times regarding the design of the new bridge. It stated to submit our opinions. Well, my husband and I both agree that if they are going to build a new bridge that it should be the Vertical Bridge.

Why would you want to spend the money on the Bascule Bridge? It will not give you the amount of clearance that the Vertical Bridge would give you. If you are going to spend the money and time on replacing the bridge you might as well spend a little bit more and get the bridge that will work best for the New Bedford Harbor.
You know that if the Bascule Bridge gets voted in, they will no sooner be done building it and then they will find out that there will not be enough clearance to accommodate the larger ships that we are hoping to do business in our port.

This is just our opinion. Hopefully, it will help you decide which bridge would be best for the New Bedford Harbor.

Thank you very much,
Susan and James Besse
JBesseFamily@verizon.net

COMMENT 10 (EMAIL)

-----Original Message-----
From: rosskess1@gmail.com [mailto:rosskess1@gmail.com]
Sent: Wednesday, August 26, 2015 2:27 PM
To: Britland, Ethan (DOT)
Subject: New Bedford-Fairhaven Bridge Study

Fix the bridge light on purchase st

Sent from my iPhone

COMMENT 11 (EMAIL)

From: 1catadam@comcast.net
Sent: Tuesday, September 01, 2015 12:18 PM
To: Weston, John
Cc: letters@s-t.com
Subject: bridge

Nothing in the article in the New Bedford Standard-Times "Choices Down to Two for New Bedford-Fairhaven Bridge" (8/19/15) pursuades me that either of the two new bridge options is a viable one. According to this article, the "new bridge would not decrease the wait for vehicle traffic;" yet it is the current "wait" that bothers most drivers. Indeed, a new bridge may not be needed at all. According to a draft report of the New Bedford-Fairhaven Bridge Corridor Study to which this article refers, because of the width of the opening that the current bridge provides boats, the "existing swing span has been cited as an issue that *may be* [my italics] limiting port activity.'" Mayor Mitchell is noted as having said that "widening the channel . . . *would* [my italics] boost the economy." There's a big difference in likelihood between "`may'" and "would." Before being subjected to the time ("33 months for construction"--that is, almost 3 years] and expense [between $100-$130 million in "capital costs"] that replacing the current bridge would apparently require, let us first have credible evidence that a new bridge *will*--not *"`may'"*--be advantageous to our community. Until then, tell our leaders to order the repair of the "mechanical problems that periodically affect the [current] bridge" that engineers have said exist.

Catherine Adamowicz
312 Maple Street
New Bedford, MA 02740
774 202-1280

"The greatness of a nation and its moral progress can be judged by the way its animals are treated." (Mohandas K. Gandhi)

COMMENT 12 (EMAIL)

From:	Edward Anthes-Washburn <Edward.Anthes-Washburn@newbedford-ma.gov>
Sent:	Sunday, September 06, 2015 12:51 PM
To:	Weston, John
Cc:	Jay Borkland; John C. Crowther; John McAllister
Subject:	Comments on New Bedford/Fairhaven Bridge Study

John-

I've been reading through the report and I think you and your team did a good job.

One thing I'd like to comment on is the SER process described on pages 5.19 and 5.20.

Because the SER process is tied to the Superfund Cleanup, it may not be available after the EPA completes their cleanup. While the EPA will have significantly lowered the levels of PCBs in the harbor, they will not touch any material below 50ppm and that sediment will remain. This material is not suitable for offshore disposal. If the bridge project is completed after the EPA leaves NB Harbor and discontinues the SER process of placing impacted sediments in Confined Aquatic Disposal Cells (CAD Cells) then it must be removed and placed in upland Toxic Substances Control Act (TSCA)-approved and monitored landfills.

The cost of upland disposal is much higher- a factor of 10 the last time we investigated. The cost of placing the material in a CAD cell is around $60/CY versus $600/CY for upland disposal (I've cc'd Apex to provide more backup information as they have the bid costs available). The cost difference could be significant when dredging the area where the current bridge sits, as either recommended alternative will require. If there is 5,000-10,000CY of impacted sediment for the project the cost of disposal goes from $300,000-$600,000 to $3,000,000 to $6,000,000. This is significant, and getting this project on the current list of dredging projects should be seen as a priority before the EPA completes their cleanup.

Thank you for your attention on this important detail. The HDC is happy to work with MassDOT to ensure this project gets on the Phase V dredging list.

Sincerely,

Edward C. Anthes-Washburn
Acting Port Director

COMMENT 13 (LETTER)

The Commonwealth of Massachusetts
House of Representatives
State House, Boston 02133-1054

September 18, 2015

Mr. John Weston, HDR
695 Atlantic Avenue
Boston, MA 02111

Re: Draft New Bedford-Fairhaven Bridge Corridor Study

Dear Mr. Weston:

We write with respect to the Draft New Bedford-Fairhaven Bridge Corridor Study report. We believe the project will provide significant improvements to the region and surrounding businesses, and we fully support the short-, medium-, and long-term recommendations outlined in the report.

Variable messaging boards, intersection improvements, and bicycle/pedestrian improvements will increase vehicular and pedestrian safety, provide for better functionality of the corridor, and increase connectivity for all users.

Further, a replacement bridge is absolutely necessary. The current bridge is functionally obsolete, has long outlived its useful design life, and will require extensive ongoing maintenance. Moreover, replacing the existing structure will allow for a reconfiguration of this narrow chokepoint and foster increased operability for the Port of New Bedford.

We note, however, that although both the Tall Vertical Lift Bridge and Double-Leaf Dutch Bascule Bridge options may have merit, due to the estimated 3-month road closure, impact to harbor operations from maintaining only one navigational channel, and unknown long-term reliability of the Double-Leaf Bascule alternative, we strongly recommend advancement of the Tall Vertical Lift Bridge option.

Thank you very much for your time and consideration.

Respectfully,

William M. Straus
State Representative
10th Bristol District

Antonio F.D. Cabral
State Representative
13th Bristol District